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INTRODUCING THE ELECTRIC TRUCK

Evidence continues to accumulate that the average central-station manager does not realize the possibilities of business for his company in the more widespread use of the electric vehicle, and more especially the electric truck. In many places, however, where the central-station management has made a study of this proposition, remarkable results have been accomplished, and the experience of such cities as New York, Boston, Chicago and Denver may well be studied by the companies in other cities which are willing to make an active effort to increase their revenue from this source.

New testimony as to what may be accomplished is presented in the experience of Newark, N. J., as related by Mr. Stephen G. Thompson at a recent meeting of the Electric Vehicle Association in New York City. The Public Service Company decided sometime ago to take this matter up and organized an automobile department for the purpose of developing a wider use of the electric truck. The results have been not only encouraging, but to those who have not kept in touch with similar developments elsewhere, may be even startling. Of the commercial vehicles now in use in this territory 26 per cent are electric and 74 per cent gasoline. However, many of the gasoline machines are light and low-grade machines more comparable to the pleasure vehicle than to a heavy truck. The remainder of the gasoline machines are outnumbered by the electric trucks and this in spite of the fact that the electrics have been supplied by only nine manufacturers in competition with 98 makers of the gasoline type. It thus appears that the more extended choice of the gasoline power wagon has been determined by the influence of numbers rather than by any advantages inherent to their use. Mr. Thompson believes from his experience in this work that the field for the electric vehicle is much larger than is usually believed, and he points out that the business can be secured at a very reasonable expenditure. This is borne out by the fact that the automobile department in his territory has spent less in its promotion work than the amount of profit already secured from this source, and a foundation has been laid for a very large increase in the revenue in the future, since results here as elsewhere are cumulative and some time is necessary to make an impression upon the prospective users.

The influence exerted by the practice of the central station is considerable and the proper example for a central station to set is well exemplified by the Commonwealth Edison Company of Chicago, which uses numerous electric trucks in handling its commercial hauling. This company has 69 electric trucks in service,

as is forcibly shown by the photographs which will be found upon other pages of this issue. This company finds the vehicle load to be increasing rapidly in its territory. Between November 1, 1910, and November 1, 1911, the number of electric vehicles doubled, and the latter figure was more than doubled again by November 1, 1912. Estimating the future increase from the experience of the past, there will be by November 1, 1913, 800 vehicles of this type in use in the city of Chicago.

Development in other cities, where proper attention has been given to this matter, has been quite satisfactory. In New York City the number of electric trucks is about 47 per cent of the total.

Ammunition for a campaign of this kind may be obtained from the investigation which is being carried out at the Massachusetts Institute of Technology, at the instance of the Edison Electric Illuminating Company of Boston. This investigation has shown that the total expense of operation of electric vehicles, including depreciation and repairs, is less than for either horse-drawn or gasoline trucks, for every purpose. The full report of this investigation, when it is available, should provide a convincing argument for every possible user of this type of truck and will leave little excuse for the central station which fails to make a determined effort to build up this addition to the load in its own territory.

THE VALUE OF AGREEABLENESS.

The electrical contractor's skill in selecting the right sort of men for his construction force plays a far more important part in determining the success of his business than is generally recognized. In a certain neighborhood where most of the electrical work consisted in wiring residences already completed and occupied, two contractors undertook to establish themselves in business. One of these men thought that an electrician's value to his employer was measured mainly by the amount of work per day which he could be depended upon to install, and he gave himself little concern as to how much of a nuisance employees of his might allow themselves to become to the people in residences where they were sent to install wiring. His competitor, on the other hand, was especially careful to send out on jobs of the kind mentioned only workmen who he felt sure would try to make themselves reasonably accommodating and unobjectionable to the family for whom the work was being done. The first of these two contractors is wondering now why his competitor's business has grown so much faster than his own.

It would be foolish, of course, to insist that an electrician should have either all the polish of a Chesterfield or the patience of Job, but a disposition to be pleasant and accommodating may be a very valuable personal asset to him. It is one which the contractor who employs men can well afford to take into account, and pay for.

THE TAXATION OF LIGHT.

A proposal in this country to place a tax upon the use of light would probably be considered ludicrous, yet such a tax is already in existence in Germany and it is now proposed to inaugurate a similar scheme in France. The tax as proposed will be placed upon the various methods of artificial lighting.

The idea cannot be considered new in France, since the long endured tax on doors and windows is indirectly a tax upon the use of daylight in interiors. Although economists and others recognize that a tax upon the necessities of life, either directly or indirectly, is not a desirable one, where the national expenditures are so high through military or other burdens that it is difficult to raise the necessary revenue, we find all kinds of burdensome and unwise taxes levied. One probable result of the adoption of such a tax as this will be a partial crippling of the electrical industry. Manufacturers of electrical apparatus and operators of central stations will thus be made to feel the heavy hand of the law, but more important than this will be the hygienic and social disadvantages of a penurious regard for artificial illumination. A plentiful supply of light is generally recognized as desirable from almost every point of view, and that a tax upon the use of lighting equipment will restrict its use cannot be denied.

In Germany it was estimated that the returns from a tax on lighting would amount to 50 million marks per annum. In adopting the scheme the Reichstag reduced this estimate to 20 million marks, yet the restriction in use was such that in 1910 the tax failed to yield this amount. It is stated that in England, where a tax on windows was in effect at the middle of the last century, one may still observe walled-up windows, which bear gloomy evidence to the result of this form of tax.

All taxes upon industry are objectionable and tend to repress rather than to encourage labor and thrift. When such taxes are indirect their effect is baneful enough, but when such a tax is levied directly it usually does more harm through repression than any advantage gained by the community from the increased revenue. Let us be thankful in this country, and especially in the electrical industry, that a tax upon light, either natural or artificial, would be regarded as too preposterous an idea to receive consideration.

RECORD LOAD FOR CENTRAL STATIONS.

That the use of electricity is ever increasing is demonstrated by the continued installation of generating equipment in nearly all power stations, as well as by the steady growth in the number of generating stations in all parts of the country. In the more congested centers of population the increase is no doubt more rapid than elsewhere and the large cities of the country show a larger and larger annual output with each succeeding year. The connected load on the system of the New York Edison Company in New York City now exceeds

a half-million kilowatts, and is growing at a rapid rate.

The largest instantaneous load carried by any central station in the world has probably been experienced by the Commonwealth Edison Company, in Chicago, as this company supplies not only a large lighting and power load, but also sells a large amount of energy to the electric railways of the city. Each year sees a new maximum load on the lines of this system during the short days of December. While in a city like New York the maximum load, being determined largely by the number of lamps being supplied, is likely to occur upon a dark afternoon, the condition of maximum in Chicago is, on the other hand, determined by the weather conditions, since the consumption of energy in the electric heaters of the street cars is then added to the peak of the lighting load. The maximum so far in the present season occurred on December 11, a day upon which a cold wave was experienced in the city of Chicago. On this day the load reached the value of 232,950 kilowatts, a record which exceeds any heretofore experienced. The energy consumption during the 24 hours of this calendar day was 2,925,500 kilowatt-hours.

The power output noted above is carried partly by storage batteries which are used to cut down the peak load on the generators. However, the generating units are sufficient to carry such a load for a short time, since it is but slightly in excess of their normal capacity, which is in the neighborhood of 225,000 kilowatts. This will soon be increased by additional generating units in the new Northwest power station.

Interest in the matter is enhanced by the competition which is carried on every year among the employees of the company and a few outsiders to see who can make the nearest estimate to the maximum load and the maximum daily consumption for the year. The possibility of a new record being reached in the few days of the year yet remaining is remote, but adds to the interest in weather conditions.

MORE ELECTRIC RESTAURANTS IN ENGLAND.

The recognition of the future possibilities to the central station by electric cooking seems to be greater in England than in this country, in spite of the fact that we usually regard ourselves as most enterprising and that most of the central stations in England are municipally owned. Attention has before been called to a restaurant in London which is being operated upon a commercial basis with electric cooking. There are already several such in London and it is announced that the number will soon be increased. The electric restaurants at present in operation there are meeting with satisfactory results and are patronized by ever increasing numbers. Two additional restaurants are now being opened upon a more pretentious scale than their predecessors. These ventures have been inaugurated by the commercial departments of the central stations which supply their respective territories.

It is especially gratifying when such restaurants can be operated with commercially satisfactory results. They have, however, a far greater import to the electrical fraternity in the demonstration which they furnish of the possibilities of electrical cooking and the advertising value which they thereby represent not only to the manufacturers of electric-cooking apparatus but as new-business getters for the central station.

Why it is that more effort along this line is not made by the central-station companies in this country is somewhat of a mystery, as the cooking load must be looked to in the future as the main factor in increased electric consumption, in all except the factory districts. The usual American enterprise has not been in evidence in this particular connection and until some persistent pioneer efforts are made to acquaint the general public in this way with the possibilities and advantages of electric cooking we can hardly look for a very rapid introduction of the electric range.

THE END OF THE YEAR.

With the present issue we round out a year of publishing which has been rich in many experiences, particularly in the inspiring support and devotion of readers and advertisers alike. The acquisition and consolidation of *Electrocraft* brought to the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN a great measure of strength and particularly in the field devoted to practical installation details this influence has been maintained and very materially increased.

The notable series of articles relating to the utilization of electrical energy in every kind of industry has been the subject of wide comment and commendation. Central-station companies in every part of the country have found this information to be of the most practical value to them, and in deference to the many suggestions which we have received with regard to the continuation of these articles, we can assure our readers that this work will be continued and the service made more valuable even than the record of the past year has indicated.

By and large the year has been a good one, and the electrical industry in line with other fields of activity has witnessed a very considerable development. Each phase of electrical work will be reviewed very carefully and at length in the New Year's number of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, which will be published next week, January 4, 1913. In thus closing the year and in looking forward to the same degree of success in the year to come, we thank our good friends for their loyal support and wish for them for 1913 a very happy and prosperous year.

With this issue will be found an index of the volume now drawn to a close, and the attention of readers is called to the advisability of carefully preserving this for future references. After the edition is exhausted it is impossible for the publishers to replace copies which have been lost.

Meter Meeting of the New York Section.

About 400 were present at the regular monthly meeting of the New York Companies' Section of the National Electric Light Association, held on December 16, at the Edison Auditorium, New York City. Samuel G. Rhodes, of The New York Edison Company, had arranged for a discussion of "Recent Developments in Methods of Electrical Measurement, with Particular Reference to Watt-Hour Meters."

Three papers were presented, all illustrated with lantern slides, by W. F. Howe, of the General Electric Company, R. C. Lanphier, of the Sangamo Electric Company, and William Bradshaw, of the Westinghouse Electric & Manufacturing Company. The meeting was thrown open to discussion after the formal presentation of these papers and the authors were called upon to answer numerous questions from the rank and file of metermen.

F. W. Smith, of The United Electric Light & Power Company, spoke briefly of his recollections of old-time meter troubles. Mr. Rhodes asked Mr. Bradshaw to explain to those present the old question of the meaning of the "constant" on the meter, and in a clever little answer was referred to page so and so in the "Meterman's Handbook."

C. A. Littlefield, of The New York Edison Company, told some reminiscences of his early experience with meters.

It is proposed at a later date to have Mr. Rhodes tell of some of the methods of the central stations in maintaining accuracy of meters after installation.

Frank M. Tait, president of the National Association, will speak at the January meeting of the Section, to be held January 20, 1913.

J. W. Lieb, Jr., of The New York Edison Company, will lecture on "Rates" at the meeting to be held February 19, 1913.

Louisville Contractors Meet.

On January 6 the annual meeting of the Louisville Electrical Contractors' Association will be held at the Builders' Exchange headquarters in the Realty Building in the Gateway City. The affair promises to be one of the most enjoyable in the history of the association, forecasting a memorable year of prosperity for the body during 1913, for more than 90 per cent of the employing and buying power of the Louisville trade is now included in the association. The present officers of the association are as follows: President, Frank Good; vice-president, C. C. Childers; secretary-treasurer, Gus Albright; directors, Herbert Ottenheimer, A. J. Anderson and Joseph Griffin.

A banquet is to provide more than the usual entertainment at the coming meeting.

New York City Discusses Improved Street Lighting.

The possibility of radical changes in New York's street lighting was the subject of a conference held on December 18 at the office of Commissioner Henry S. Thompson, of the Department of Water Supply, Gas and Electricity. This meeting of lighting experts, summoned by the commissioner, was in no sense a criticism of present methods but rather to learn of new developments in this direction, both in lighting units and fixtures.

The particular feature under immediate consideration was the possible adoption of the new flaming arc lamp, with which experimental lighting has been done here in New York recently on a large scale, especially in the neighborhood of Broadway and Fiftieth Street.

Commissioner Thompson has been watching these developments with interest, the chief difficulties at present being a flicker in the light from the flaming arc and the excessive cost of the carbon employed. In the opinion of the experts gathered at the conference it is only a matter of a few months before these faults in the flaming arc will be eradicated. As soon as the new lamp is finally perfected, Commissioner Thompson explained, he will be ready to act, but he feels it necessary to wait until such is the case rather than to embark the city in any large outlay until the experimental stage is past.

When the substitution is made expense will be limited largely to the purchase of new units, for it has been discovered that it will be possible to convert the present lamp posts for use with the flaming arc. Indeed, Commissioner Thompson secured the present design of standard with this in view. Where the flaming arc is employed, it is necessary to raise it far higher than the ordinary arc to obtain the desired distribution of light. It will be possible, however, to introduce a taller steel shaft into the present post, without making it necessary to have a special standard, thus reducing greatly the possible cost of installation.

Following the conference held Wednesday last week there will be another at which further developments with regard to flaming arc improvements are expected. The call to these conferences sent out by Commissioner Thompson reads as follows:

"New York City has come to be known and is now recognized as one of the best and most scientifically lighted cities in the world and many favorable comments from experts have been received on this question. However, the style of lighting has not been changed for some years and I do not think, considering the rapid strides made in the electrical industry in all its branches, that we should rest content with what has been done."

Among those summoned to confer with Commissioner Thompson were Dr. George F. Sever, professor at Columbia College and special expert for the city; C. F. Lacombe, chief engineer of light and power of the Department of Water Supply, Gas and Electricity; E. H. Rosenquest of the Bronx Gas & Electric Company; F. W. Smith and J. G. Swallow of the United Electric Light & Power Company; Messrs. Rugg, Rypinski and Pace of the Westinghouse Electric & Manufacturing Company; Mr. Thomson of the Adams-Bagnall Company; Dr. K. G. Frank of the Siemens-Schuckert Company; C. G. Thomas of the New York & Queens Electric Light & Power Company; W. F. Wells of the Richmond Light & Railroad Company. Messrs. Birge and Brake of the General Electric Company, and Arthur Williams, S. G. Rhodes and John W. Lieb, Jr., of the New York Edison Company.

National Electric Light Association Endorses Co-Operative Electrical Movement.

At a special joint meeting of the Executive Committee and the Public Policy Committee of the National Electric Light Association, held in New York City on December 17, it was resolved that the Association endorse and support the plan outlined by the Society for Electrical Development which has been explained and amplified in these columns. The main object, as is understood, is the raising by a small percentage dues of a sum large enough in the aggregate to secure general and effective national publicity for electrical service and apparatus. Henry L. Doherty, chairman of the Committee on Organization of the new society, made a statement as to the plans. It is understood that the two committees heartily commend the activities of the new society to the 1,275 companies represented in the National Association. These companies embrace something like 90 per cent of the capital and earnings of the central-station industry.

Chicago Electric Club.

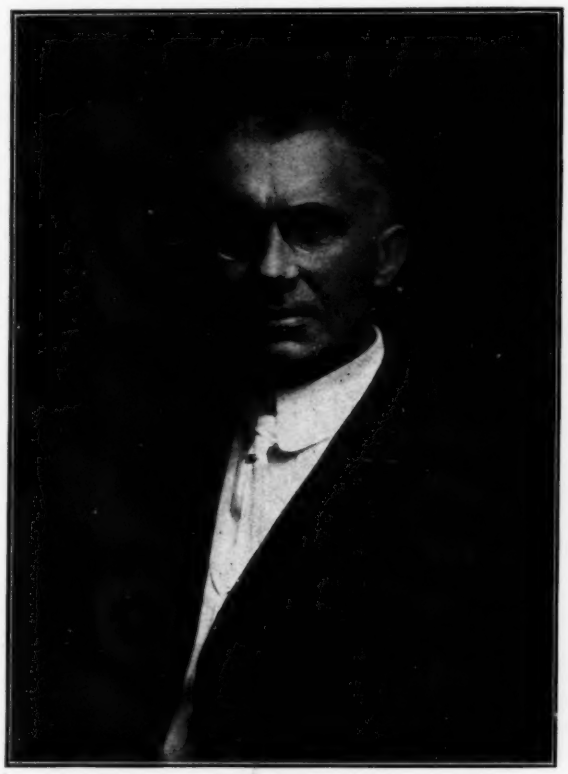
An innovation in the affairs of the Electric Club of Chicago was the "Ladies' Day" held on December 19, at which Mrs. Minona Fitz-Jones gave a most interesting talk on "The Greatest Discovery of the Age." Frederic P. Vose also spoke in his usual entertaining manner. Over 100 members and guests were present.

Emile Berliner.

The meeting of the Telephone Pioneers of America at New York City on November 14, was enlivened by a most interesting address by Emile Berliner, than whom few can speak with more authority with regard to the early development of the electric telephone. Mr. Berliner related how great was the speculation at the time of the invention with regard to the scientific principles underlying the action of the loose-contact microphone, and in a very amusing way detailed his own theories thereupon. From his testimony upon the occasion just referred to it appears that in 1877, when he had discovered to his own satisfaction that a loose contact would transmit speech, and also that a loose contact would reproduce speech, he was as a loss to properly explain what he had invented. His demonstration of these phenomena to Joseph Henry of the Smithsonian Institution at that time brought him little relief, although the eminent Henry was greatly interested in the use to which Mr. Berliner had put the induction coil, or as he called it, the inductorium.

Emile Berliner was born at Hanover, Germany, May 20, 1851, the son of Samuel and Sally (Fridman) Berliner. He graduated from the Samson School at Wolfenbuttel in 1865, and came to the United States in 1870. His invention of the loose-contact telephone transmitter or microphone, is dated in 1877, April of that year being the first time that an induction coil had been used in connection with transmitters, and a patent was allowed him in January, 1878. He is the patentee also of other valuable inventions in telephony, and in 1877 invented the gramophone, the first talking machine, which utilizes a groove of even depth and varying direction, and in which the record groove not only vibrates the stylus, but also propels it across the record. For this invention he was awarded the John Scott medal by the Franklin Institute at Philadelphia. Shortly after the invention of the loose-contact telephone, Mr. Berliner joined the staff of the Bell Telephone Company, where in concert with the other early workers of that day, he contributed very materially to the electrical and mechanical features of this device, also serving in various capacities involving the commercial introduction of the telephone.

Since 1901 Mr. Berliner has been engaged in educational work, taking a conspicuous part in public affairs looking to the improvement of conditions of living and the protection of the public against the dangers prevalent in the use of uninspected and poorly prepared food materials. He is the author of several pamphlets dealing with the prevention of sickness, and in 1907 planned and was a member of the Washington Milk Conference. He has been for a long time and is now a resident of Washington, D. C., where on December 26, 1881, he married Miss Cora Adler of that City.



Emile Berliner,
Noted Inventor and Telephone Expert.

Colorado Electric Club.

Frank L. Newhouse, of the Central Savings Bank and Trust Company, of Denver, addressed the members of the Colorado Electric Club on the agricultural possibilities of Colorado, at the regular weekly luncheon at the Albany Hotel on December 19.

This subject is one in which every electrical man in the West is deeply interested, as a great deal of reclamation of arid land is now being done with electrically driven pumps. Mr. Newhouse's talk brought out many facts about the possibilities in this state, which when combined with electrical endeavor assume great proportions.

Boston Motor Meeting.

The Boston Electric Motor Car Club met on December 19 at the Hotel Thorndike. A larger number of members and guests was present than at any preceding meeting. The gathering was mostly given over to Christmas festivities, but a short business session preceded the merrymaking. Plans for an Electric Vehicle page of co-operative advertising, to be published in the Boston *Sunday Herald* about January 15, were considered. Albert Weatherby, of the Publicity Committee, told of the practice which prevails in other cities of employing a Club Press agent and recommended that one be employed by the Boston organization. He advocated getting out a booklet to set forth the advantages of membership in the Boston Motor Car Club. The committee was empowered to issue such a publication.

Treasurer Codman stated that there are now 73 paying members enrolled. President Baker called attention to the prediction of a prominent Boston physician that in ten years horses would no longer be in use in the city, the streets being devoted exclusively to motor traffic.

The following newly appointed committees were announced: Publicity, Albert Weatherby, H. F. Thomson, P. E. Whiting, D. C. Tiffany, E. N. Phelps. Civic Relations, J. W. Bowman, D. C. Tiffany, Day Baker.

Vice-President Mansfield and Leavitt L. Edgar played the part of Santa Claus, distributing from a tree illuminated with colored electric lights, presents that were particularly appropriate to the recipients. President Baker received a gavel, Treasurer Codman a tin bank, Secretary Thomas a fountain pen, Frank J. Stone an autograph photograph of Thomas A. Edison. Each presentation was accompanied by apt and clever verses composed by Edward S. Mansfield. The recital of several selections by La Rue Vredenburg, of the Boston Edison Company, and vocal solos by M. A. Frank completed the exercises. A male quartette sang during the dinner.

Copper exports from Chile for the first seven months of 1912 show a gain of 3,400 tons over a like period of 1911, with prospects of a larger relative gain for the balance of this year. These figures will be available later.

Western Union Changes—Belvidere Brooks to Be Made a Vice-President.

Formal announcement will be made shortly by the Western Union Telegraph Company of important changes in titles and authorities to become effective Jan. 1. The changes will include the advancement of Belvidere Brooks from the position of general manager to that of a vice-president, with headquarters at New York, in charge of commercial and public relations.

Changes in titles will mark the abolition of the title of general superintendent of each of the principal geographic divisions of the company. The following changes are in connection with officials reporting to Mr. Brooks:

A. G. Saylor, from general superintendent to general manager of eastern division, with headquarters in New York; T. P. Cook, from general superintendent to general manager of western division, with headquarters at Chicago; W. J. Lloyd, from general superintendent to general manager of mountain division, with headquarters at Denver; C. H. Gaunt, from general superintendent to general manager of Pacific division, with headquarters at San Francisco, and H. C. Worthen, from general superintendent to general manager of southern division, with headquarters at Atlanta.

New York Electrical Society Inspects Grand Central Terminal.

The New York Electrical Society celebrated its three hundred and fifteenth meeting with an inspection of the new Grand Central Terminal, New York City, on Thursday, December 19, at 12:30 p. m. The members were escorted by the engineers of the New York Central & Hudson River Railroad Company through the passenger station, and on entering the suburban concourse were presented with a special souvenir booklet containing diagrams showing the route to be followed in the inspection, illustrated descriptons of the various buildings and complete information with regard to the electrical, mechanical, historical and civic features of the terminal. Carl Schwartz, electrical engineer in charge of terminal improvements, made an address to the 400 visitors, and the railroad company provided refreshments and cigars.

Special Statesman Appointed for Peoria Jovian Rejuvenation.

Announcement is made that W. E. Wolgamott, city electrician of Peoria, Ill., has been appointed Statesman to assist in the rejuvenation of the Jovian Order which will be held on January 23.

Electrical Illumination for Panama Exposition.

The electrical effects at the Panama-Pacific Exposition in San Francisco in 1915 promise to excel any attempt at illumination ever seen in this country. W. D'A. Ryan, the illuminating engineer of the exposition, in talking about some of the novelties and wonderful illuminations said: "One of the special features will be the illumination of jewels in place of the incandescent lamps so commonly used at previous expositions. The whole effect will be surmounted by 48 electric scintillators, one for each state, which will be mounted off the main axis of the exposition about 500 to 600 yards out of the water. They will be placed on barges anchored in the bay and will require sixty trained men to operate the lights. They will go through an evolution of color, forming auroras and various effects in the sky and over the exposition and will spread like a great lily, that can be seen in all the surrounding bay cities and on clear nights will be visible in the sky for 40 to 50 miles, approximately. The prevalence of fog in San Francisco will assist in the production of wonderful lighting effects. The lighting of the exposition will without doubt surpass anything in the world's history. One of the strongest features will be the fact that effects will be produced that have never been seen before. The entire scheme is new in every respect and will be an epoch in illumination. The advance, since the last big exposition, in science and art of electric engineering and development of electric apparatus has been so great that we are now able to produce effects with economy which would have been physically impossible five or six years ago. In other words the exposition is to be a magnificent picture with the architectural splendor brought out to the best possible advantage in both form and color, maintaining the daylight perspective."

Trans-Isthmian Electric Transmission Line.

Survey began this month for the location of towers to carry the electrical transmission line which will follow the relocated line of the Panama Railroad from Cristobal to Balboa, connecting terminal substations at those points. The line will be fed normally from the Gatun hydroelectric station, and will be tied into the permanent steam generating station at Miraflores. Energy will be transmitted along this line at a potential of 44,000 volts, in delta connection, and reduced at centers of distribution to the requisite potentials for the operation of machinery and for lighting.

Each tower is to be a track-span bridge, consisting of two side frames connected by a cross-bridge, all of skeleton steel construction. The bridge is to support duplicate three-phase lines, one on either side of the track, a ground wire strung from the top of each side-frame, messengers and cables for duplicate telephone trunks and for track signal circuits, and the necessary messengers and wires for a catenary trolley construction should the Panama Railroad be electrified. The track-span bridges will be located from 200 to 300 feet apart, according to the curvature of the tracks. Under the specifications being prepared, preliminary to advertising for bids on furnishing materials for the line, 725 single-track and 100 double-track bridges will be required, with 2,000,000 feet of copper wire, No. 00, B. & S. gauge, 6,500 three-unit suspension insulators, and 1,000 ground-plates.

In as much as the Panama Canal Commission has secured poor deliveries upon recent requirements of structural-steel fabrications, in connection with unfavorable prices on both steel and copper in the United States market, foreign manufacturers will be invited to compete for furnishing materials for the transmission line.

Electrical Contractors' Association of Cincinnati.

The local association of electrical contractors in Cincinnati is closing a year of pleasing activity and growth. The association meets regularly twice each month, the meetings being held on the first and third Mondays, at 3 o'clock in the afternoon, at the Havlin Hotel. The next annual election of officers will take place on January 6, 1913.

The membership of the association is not restricted to the city of Cincinnati; the aim is to include contractors in the immediate vicinity of the city as well. Charles M. Beltzhoover is the secretary of the association.

Graduate Course in Telephone Engineering.

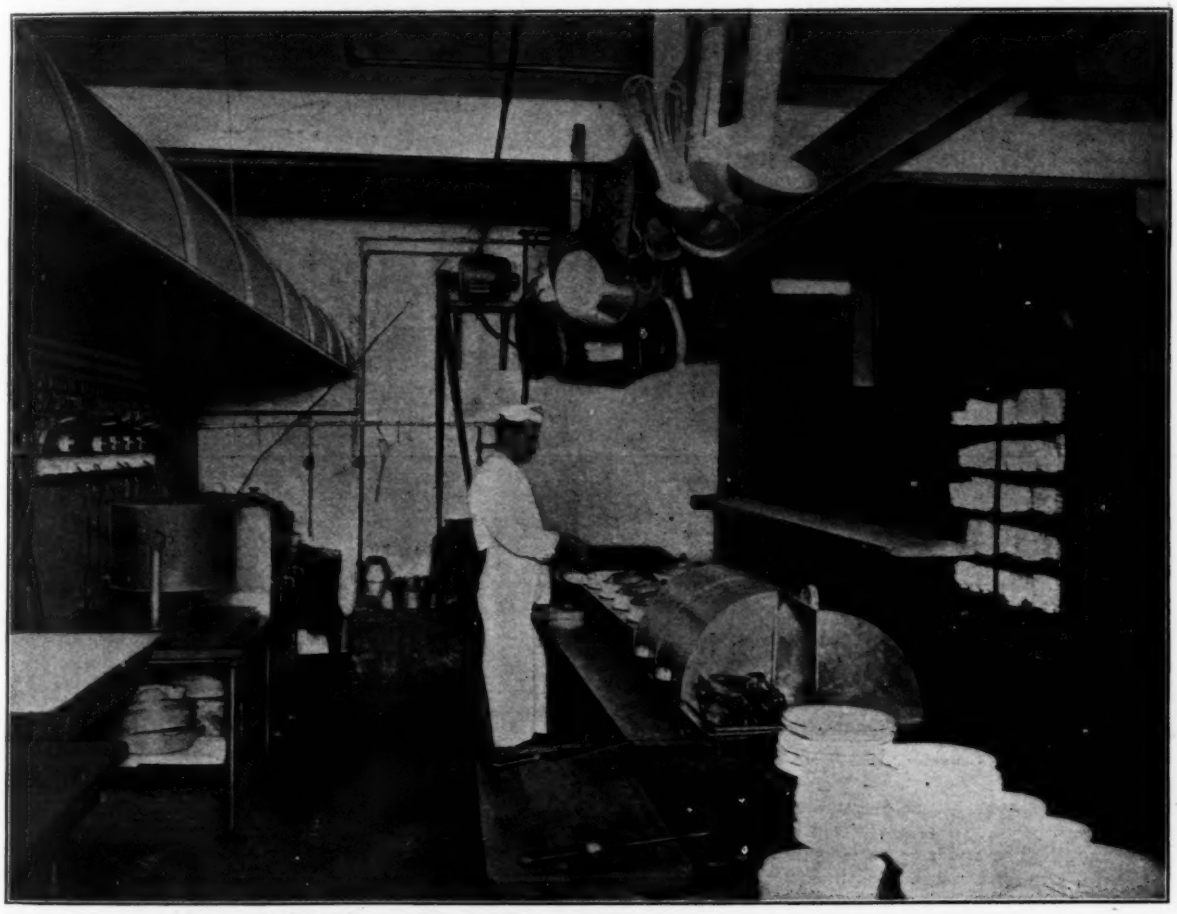
An advanced course in telephone engineering will be given early next year at Lewis Institute, Madison and Robey Streets, Chicago, Ill. This course is intended for graduate students and will be given by Prof. Arthur Bessey Smith, who for many years taught this subject at Purdue University. The course will comprise both lecture and laboratory work and will include particularly a study of manual, automatic and combination switching equipment. This work will be given Monday and Wednesday evenings for ten weeks, beginning on January 6, 1913.

Electricity in Hotel Service—III.

The subject of electricity in hotel service has been treated in three articles. The first dealt with motor applications, the second with illumination problems in hotels. This, the final article, discusses briefly cooking and heating applications. Also, a summary of motor and lighting data are given on numerous hotels purchasing power.

In the two preceding issues electricity in hotel service was discussed from the standpoint of motor applications and lighting. The present article will treat briefly of the applications others than those treated, the most important of which are electric cooking and heating. While the utilization of electrical energy for general hotel heating and cooking is yet in its infancy, the marked development in efficient apparatus indicates that gratifying progress will be made in this field hereafter.

It is unnecessary to review the many advantages of electric heat. Such devices as curling irons, hot-water heaters, sewing-tray heaters, cigar lighters, radiators, laundry appliances, etc., are well known and widely used in hotel service. Large electric ranges ovens, broilers, griddles, etc., have been used less frequently, but offer the same advantages as the smaller appliances. This is demonstrated convincingly in the case of a hotel restaurant in the East. The equipment here consists of large baking and roasting ovens, broilers, stock kettles, grids, stew pans, steam table, plate warmer, hot plates, cereal cookers, etc. Potato peelers, dish washers and other machines are motor driven. Between 1,300 and 1,800 people are served daily. During one week, which is considered typical, 7,000 people were served, 3,759 ordering a full meal. This required 1,420 kilowatt-hours, or about 290 watts per person per meal. At a rate of five cents per kilowatt-hour, this amounted to 1.5 cents per person per meal.



Section of a Hotel Kitchen Equipped with Electric Range, Ovens, and Other Electrical Appliances.

One of the most completely equipped hotels from the electrical standpoint is the Stanley Hotel, at Estes' Park, Colo. Electricity is used in this hotel for cooking, heating, lighting, laundry, etc. Between 300 and 400 guests can be accommodated.

The baking oven is divided into two compartments, each 45 inches wide, 32 inches deep and 18 inches high. It will bake 100 one-pound loaves of bread in 45 minutes, consuming a maximum of 10 kilowatts. The baking, however, is done on medium heat, or five kilowatts, so that the total consumption amounts to 3.75 kilowatt-hours. Using the high heat makes the oven an excellent pastery baker.

Here are two roasting ovens. The inside dimensions are 23 inches wide, 24 inches deep and 16 inches high. Thirty-five pounds of beef can be roasted in three hours. On medium heat the demand is two kilowatts, and on high heat 3.6 kilowatts.

The two-compartment broiler has a total broiling area of 28 inches by 32 inches. It takes three minutes to attain the broiling temperature. A

steak one inch thick can be broiled in from 5 to 6 minutes. Each compartment has a demand of 5 kilowatts.

The 20-gallon stock kettles installed, three in number, have three-heat regulation, the maximum demand being five kilowatts.

No doubt the most carefully planned, as well as most complete hotel electric cooking and heating equipments are those installed at the Hotel Moserboden and Eismeer, in Europe. In the former two kitchens have been equipped. In the smaller kitchen of diameter, each having a demand of 1.5 kilowatts; and four 8.75 inches in diameter, each having a demand of one kilowatt. The total maximum demand of the range is 11.2 kilowatts.

In the larger kitchen is installed a range similar to that already described. It contains eight cooking plates. Built into the framework of the range are two roasting ovens, each having a maximum demand of three kilowatts. All regulating switches are mounted on the frame. The total demand of the whole range is 16.2 kilowatts.

watts. There are also a large number of electric irons used.

The following shows the total demand exclusive of that required for heating the rooms:

Small kitchen	15.2	kilowatts
Large kitchen	31.1	"
Loundry	11.1	"
Hot-water plant	36.	"
Total	93.4	"

The general heating of the hotel is also carried out by electricity. The dining room contains a stove, consisting of 28 flat elements, each having a demand of 300 watts, and placed in-

Another View of Hotel Kitchen Equipped with Electric Range, Ovens, and Other Devices.

the two are fitted a boiler for soup and meats, a potato steamer and a table range. The boiler has a demand of three kilowatts when operating a full load, but it can be regulated to take either one or two-thirds this amount. Its capacity is 15 gallons, which can be brought to the boiling point in 30 minutes. The potato steamer is made of copper and has a capacity of 10 gallons. It is water jacketed and when supplied with hot water can be brought to the boiling point in 10 minutes. The maximum demand is one kilowatt.

The table range is made of wrought iron, with a cast-iron top plate. There are four cooking plates 12 inches in

The hot-water plant for supplying the kitchen, laundry, etc., consists of four boilers, each with a capacity of 90 gallons. Each boiler is fitted with 12 tubular heaters with a maximum demand of 0.75 kilowatts each, or a total of nine kilowatts per boiler. The hourly consumption of hot water at 194 degrees Fahrenheit is 50 gallons, for the heating of which 25 kilowatt-hours is consumed. In order, however, to use the boiler as a kind of an accumulator for the storage of energy the heaters have been arranged for a much higher consumption.

The laundry of the hotel contains a heater similar to the above, but having a maximum demand of five kilo-

side a closed tiled stove. The office, reading room and lobby are provided with similar heaters, having a demand of 1,200, 1,400 and 2,400 watts respectively.

The bedrooms have heaters varying in capacity from 600 to 1,800 watts, according to the size of the room. All the various stoves are fitted with triple regulation, and each has its separate switchboard with switches and fuses. As a basis for calculating the size of the various heaters, the outside temperature was taken as zero degrees centigrade and the maximum temperature to be attained 18 degrees centigrade. The time allowed for reaching this temperature was two hours.

Hotel Data—Sheet No. 1.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use of 24 hours every day of power corresponding to the rated capacity of the motors connected.

Hotel located in St. Louis, Mo., having an aggregate floor area of 157,965 square feet.

Total connected horsepower, 95. Total number of motors installed, 7. Average kilowatt-hours per month, power, 5,860.

Total lighting load, 124.4 kilowatts. Average kilowatt-hours per month, lighting, 25,772. Average watt-hours per square foot of floor space, 162.

MONTHLY CONSUMPTION.

Month	Power K. W. H.	Light K. W. H.	Watt-Hrs. per sq. ft.	Month	Power K. W. H.	Light K. W. H.	Watt-Hrs. per sq. ft.
January	5,864	33,268	215	July	7,137	17,495	111
February	4,143	33,192	210	August	5,091	26,850	169
March	6,190	30,274	191	September	5,996	24,071	152
April	5,765	25,837	162	October	6,722	24,120	153
May	6,415	22,538	143	November	5,352	20,652	131
June	5,941	18,029	114	December	5,712	31,948	202

Power load-factor 11.4 per cent. Lighting load-factor 28 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. Direct current, 230 volts.

No.	Horse-power	Speed R. P. M.	Application.
2	15	Varying	Each direct-connected to elevator mechanism.
1	5	1,200	Belted direct to ice crusher.
1	7.5	1,120	Belted to vacuum-cleaning plant.
2	20	900	Each direct-connected to ventilating fan.
1	12.5	.....	Direct-connected to house pump.

St. Paul Hotel, St. Paul, Minn. Has 300 rooms and is 12 stories high.

Total connected load, 400 kilowatts. Average kilowatt-hours per month, 74,000. Load-factor, 26 per cent.

Total connected horsepower, 272.5. Total number of motors installed, 33. Average kilowatt-hours per month, 41,750. Load-factor, 32.7 per cent.

Total lighting load, 200 kilowatts comprising approximately 4,000 50-watt lamps. Average kilowatt-hours per month, 32,400. Load-factor, 19.2 per cent.

MONTHLY KILOWATT-HOUR CONSUMPTION.

Month	Power	Light	Total	Month	Power	Light	Total
January	38,610	32,880	71,490	July	43,710	27,670	71,380
February	40,310	35,350	75,660	August	47,490	31,030	78,520
March	32,220	30,220	62,440	September	41,520	32,470	73,990
April	38,360	34,800	73,160	October	38,620	33,940	72,560
May	44,200	32,120	76,320	November	47,220	34,470	81,690
June	44,670	28,720	73,390	December	44,140	34,840	78,980

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts direct current, and three-phase, 60 cycle, 220 volt, alternating current.

No.	Horse-power	Speed R. P. M.	Application.
1	17.5	800	Direct-connected to one 1,800-pound capacity freight elevator.
1	20	800	Direct-connected to one passenger and freight elevator.
2	35	800	Each direct-connected to one passenger elevator.
1	7.5		Direct-connected to one passenger elevator.
1	35	900	Belted direct to one 15-ton Linde ice machine, supplying 19 boxes.
1	15	900	Belted direct to one 8 by 8-inch air compressor.
1	20	840	Belted direct to one 5 foot 6 inch Sirocco kitchen exhaust fan.
1	20	840	Belted direct to one 5 foot 6 inch main blower fan.
1	7.5	900	Geared to one 90-gallon-per-minute cold-water pump.
1	7.5	900	Geared to one 90-gallon-per-minute hot-and-cold-water pump.
1	4.5	900	Geared to one 50-gallon-per-minute hot-water pump.
1	0.33	1,150	Geared to one heat regulator.
1	1	1,150	Belted direct to one air washer.
1	3	1,200	Belted direct to one ice-water circulating pump.
1	7.5	1,165	Connected by silent chain to one vacuum cleaner.
1	0.166	1,200	110-volt motor-generator set for elevator signals.
1	3	1,800	Geared to ice crusher.
1	0.333	1,000	Belted direct to one potato peeler.
1	0.333	870	Belted to one broiler exhaust.
1	1	1,750	Belted direct to dish washer.
1	1	1,750	Belted direct to one ice saw.
1	3	1,800	Belted direct to one 30-inch fan, for fresh air supply.
1	0.25	1,750	Direct-connected to one silver polisher.
1	3	1,000	Belted direct to one four-foot Sirocco exhaust fan.
1	3	1,200	Each connected by chain to one Sirocco four-foot exhaust fan.
2	0.333	1,250	110-volt motor direct-connected to telephone-booth exhaust fan.
1	3	1,720	Belted to line shaft driving one small compressor; one collar ironer; one collar dryer; one shirt edger; and one flat roll, 8 feet wide.
1	10	1,720	Belted to line shaft driving three six-foot Troy washers; one three-foot Troy washer; and two 24-inch wringers.
1	3	1,140	Geared to one 48-in Troy mangle.
1	1	1,720	Belted direct to one 6 by 6-foot dry room.

Hotel Data—Sheet No. 2.

Hotel in St. Louis having an aggregate floor area of 100,000 square feet.

Total connected load, 184.71 kilowatts. Average kilowatt-hours per month, 30,397. Load-factor, 22 per cent.

Total connected horsepower, 100.5. Total number of motors installed, 10. Average kilowatt-hours per month, 8,740. Load-factor, 16 per cent.

Total lighting load, 109.34 kilowatts. Average kilowatt-hours per month, 21,657. Avearge watt-hours per square foot per month, 216. Load-factor, 27 per cent.

MONTHLY CONSUMPTION.

Month	Power K. W. H.	Light K. W. H.	Watt-Hrs. per sq. ft.	Month	Power K. W. H.	Light K. W. H.	Watt-Hrs. per sq. ft.
January	8,070	24,950	250	July	8,700	20,850	208
February	8,940	22,050	220	August	9,270	22,850	228
March	9,240	21,840	218	September	8,370	21,460	215
April	8,520	20,010	200	October	9,390	21,100	211
May	8,820	21,390	214	November	8,370	19,410	194
June	8,610	20,460	205	December	8,580	23,520	235

MOTOR INSTALLATION.

The following is a list of the motors installed with respective drives. The supply source is 230 volts direct current.

No.	Horse-power	Speed R. P. M.	Application.
3	5	1,120	Each belted direct to 48-inch ventilating fan.
1	1	1,200	Belted direct to ice-cream freezer.
1	7.5	900	Connected by chain to sump pump.
1	5	1,200	Belted direct to vacuum cleaner.
2	27	.....	Each direct-connected to elevator mechanism .
1	16	.....	Direct-connected to elevator mechanism.
1	2	1,150	Belted direct to exhaust fan.

Energy is supplied by the Union Electric Light & Power Company.

Hotel, name withheld, having 150 rooms and being four floors high.

Total connected load, 36 kilowatts. Average kilowatt-hours per month, 5,880. Load-factor, 22.6 per cent.

Total connected horse-power, 20.75. Total number of motors installed, 7. Average kilowatt-hours per month, 1,123. Load-factor, 11.5 per cent.

Total lighting load, 20 kilowatts. Average kilowatt-hours per month, 4,740. Load-factor, 32.9 per cent.

MONTHLY KILOWATT-HOUR CONSUMPTION.

Month	Power	Light	Total	Month	Power	Light	Total
January	1,202	5,656	6,859	July	1,089	3,521	4,610
February	1,395	5,349	6,744	August	1,137	4,234	5,371
March	877	4,463	5,340	September	1,167	5,089	6,256
April	1,091	4,399	5,490	October	1,014	5,289	6,300
May	1,073	3,677	4,850	November	1,183	5,417	6,600
June	1,109	4,241	5,349	December	1,154	5,580	6,734

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 110 volts and 220 volts alternating current and 220 volts direct current.

No.	Horse power	Speed R. P. M.	Application.
1	0.25	1,000	Belted direct to one potato peeler.
1	0.5	1,000	Belted direct to one dish washer.
1	0.5	1,000	Direct-connected to one grindstone.
1	0.5	1,000	Belted direct to one ventilating fan.
1	0.5	1,000	Belted direct to one ventilating fan.
1	3.5	1,800	Belted direct to vacuum cleaner.
1	15	1,500	Direct-connected to one passenger elevator.

Hotel located in St. Louis, name withheld, having an aggregate floor space of 237,580 square feet.

Total connected load, 386.7 kilowatts. Average kilowatt-hours per month, 58,455. Load-factor, 28 per cent.

Total connected horsepower, 205.5. Total number of motors installed, 12. Average kilowatt-hours per month, 23,147. Load-factor, 20 per cent.

Total lighting load 234.1 kilowatts, which includes small fan and utility motors on lighting circuits. Average kilowatt-hours per month, 35,308. Average watt-hours per square foot per month, 140. Load-factor, 22 per cent.

MONTHLY CONSUMPTION.

Month	Power	Light	Watt-Hrs. per sq. ft.	Month	Power	Light	Watt-Hrs. per sq. ft.
January	24,270	40,500	170	July	20,160	25,300	107
February	17,520	33,200	140	August	24,840	35,200	148
March	25,470	37,800	159	September	23,370	33,700	142
April	23,610	36,000	151	October	23,910	37,900	160
May	24,480	35,497	149	November	22,500	38,300	161
June	23,790	29,100	122	December	23,850	41,200	173

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 500 volts, and 200 volts, direct current.

(Continued on next page)

Hotel Data—Sheet No. 3.

No.	Horse-power	Speed R. P. M.	Application.
2	5	1,120	Each belted direct to printing press.
1	7.5	900	Belted direct to furnace stoker.
1	7.5	1,120	Belted to line shaft driving small woodworking machines in carpenter shop.
1	10	1,200	Belted to shafting driving ice-cream freezer; and one ice crusher.
1	3	900	Belted direct to dish washer.
1	17.5	850	Direct-connected to ventilating fan.
3	35	.....	Each driving elevator mechanism.
2	22.5	.....	Each driving elevator mechanism.

Energy is supplied by the Union Electric Light & Power Company.

Hotel Sherman, Chicago, Ill., 757 rooms.

Total connected load, 838 kilowatts. Average kilowatt-hours per month, 118,825. Load-factor, 18.4 per cent.

Total connected horsepower, 726. Total number of motors installed, 57. Average kilowatt-hours per month, 64,367. Load-factor, 17 per cent.

Total lighting load, 297 kilowatts. Average kilowatt-hours per month, 54,457. L 1 factor, 25 per cent.

MONTHLY KILOWATT-HOUR CONSUMPTION.

Month	Light	Power	Total	Month	Light	Power	Total
September	39,770	66,070	105,840	March	64,990	63,560	128,550
October	46,590	69,470	116,060	April	57,450	56,160	113,610
November	49,270	64,330	113,600	May	58,430	60,490	118,920
December	57,910	66,230	124,140	June	57,100	63,180	120,280
January	56,320	62,830	119,150	July	54,800	67,390	122,190
February	61,180	62,260	123,440	August	49,680	70,440	120,120

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is 220 volts, direct current.

No.	Horse-power	Speed R. P. M.	Application.
2	5	900	Connected by chain to two circulating ice-water pumps.
1	1	1,200	Belted direct to emery wheel.
2	15	900	Each belted direct to a ventilating fan, 22,500 cubic feet capacity each.
2	3.75	1,200	Each driving air washer.
4	36	63	Direct-connected to four 2,500-pound capacity passenger elevators.
1	5	950	Belted to line shaft driving one shirt ironer; two body ironers; one sleeve ironer; one shirt press; and one collar ironer.
1	0.5	550	Belted direct to collar dampener.
1	0.25	1,500	Belted direct to starcher.
1	1	1,200	Direct-connected to extractor.
1	0.25	725	Direct-connected to cuff starcher.
1	1	1,200	Direct-connected to dry room.
1	1	1,200	Direct-connected to flat-work ironer.
1	3	1,200	Belted direct to Trojan mangle.
1	3	1,200	Belted direct to small mangle.
1	1	1,040	Belted direct to towel dryer.
1	1	1,200	Belted to blower for above machine.
2	15	600	Each belted to a line shaft driving six washers, and one extractor.
2	32.5	265	Each direct-connected to Sturtevant exhaust fan, 27,000 cubic feet capacity.
1	3	1,650	Direct-connected to New Era dough mixer.
2	40	750	Each belted direct to exhaust fan, capacity 39,000 cubic feet.
1	30	575	Belted direct to 38,000-cubic-foot capacity exhaust fan.
2	25	800	Each driving elevator mechanism.
1	1	2,000	Direct-connected to Golding job press.
1	0.5	1,500	Direct-connected to pony press.
2	25	235	Direct-connected to exhaust fans.
3	1	1,150	Each belted direct to dish washers.
1	20	900	Belted direct to 20,000-cubic-foot-capacity blower.
2	25	900	Each belted direct to blower, 27,000 cubic feet capacity.
1	3	1,050	Belted direct to ice-cream freezer.
1	0.5	1,600	Belted direct to Read egg beater.
1	0.5	1,100	Belted direct to potato peeler.
1	2	1,840	Belted direct to meat grinder.
1	1.5	1,200	Direct-connected to coffee grinder.
1	0.25	1,400	Belted to carbonator.
1	7.5	900	Belted direct to coal conveyor.
1	25	1,500	Belted direct to fan.
1	10	800	Driving freight elevator.
3	9	1,000	Each direct connected to bilge pump.
1	30	575	Belted to fan, capacity 39,000 cubic feet.
1	25	700	Belted direct to fan, 32,500 cubic feet capacity.
1	2	1,100	Belted direct to ice crusher.

Energy is supplied by the Commonwealth Edison Company.

Commercial Practice
Management, Rates, New Business

The Basis of Rates.

Albert C. Ritchie, who attracted wide attention by his conduct of the people's case in the investigation of electric rates in Baltimore, made an address on December 21, before the American Society of Jurisprudence, in Washington, D. C., on the subject "Should the State Fix Rates on the Basis of a Fair Return Upon the Investment?" In part, Mr. Ritchie said:

It is provided by the Interstate Commerce act and by statute in 29 states that the rates to be charged by central stations and other public-service corporations shall be just and reasonable. None of these enactments prescribe any standard for determining what is a just and reasonable rate. Sometimes it is provided that certain elements may or shall be considered as, for example, the value of the company's property, the character and nature of the services, etc. These considerations, however, are never made exclusive.

It is, of course, true that the words "just and reasonable" are not fixed unalterable, mathematical terms, but that they imply the exercise of judgment. It is, however, equally true that ours is a government of laws and not of men, and the stability of our institutions requires that those in authority, particularly those in judicial or quasi-judicial authority, must exercise no arbitrary power.

An examination of the decisions of the courts and the commissions during recent years shows that these tribunals say there are two standards which should be applied in order to ascertain reasonable rates: (1) Rates should be based upon the value of the service rendered. (2) Rates should be such as to yield a fair return, and no more, upon the legitimate investment in the business. It is also often said that the cost of the service is the proper test, and this is, of course, a consideration of prime importance. The cost of the service, however, properly understood, includes not only actual expenditures, but also a fair return upon the capital invested in the service, and since the fair return upon the investment is not estimated until after the proper cost of the service has first been allowed, it follows that the cost-of-service theory and the fair-return-upon-the-investment theory are not at all inconsistent, but on the contrary are fundamentally the same. Bother theories contemplate a fair return on the investment after the cost of rendering the service has been first ascertained and allowed.

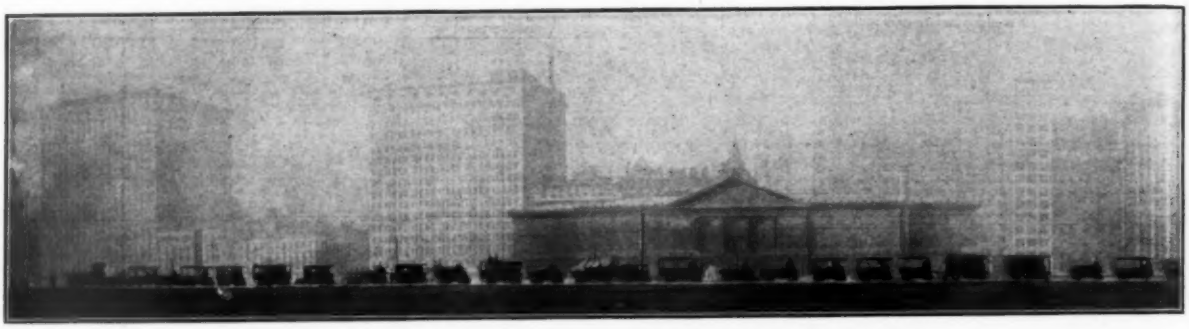
It has been urged that to restrict the profits of a public-service corporation to a fair return on the investment would result in destroying business incentive and progressiveness of management. It should be observed however, that corporate efficiency is the efficiency of the operating department, and the public pays for this when it pays rates high enough to cover all operating salaries and the expenses. Surely the public should not be required first to pay the salaries of efficient officers and then to pay the investors an increased reward because they have employed efficient officers.

Moreover, efficiency is transitory, and appertains largely to the individual. Certainly rates should not be fixed on the theory of rewarding progressiveness and incentive when tomorrow a change in ownership or management may see the progressiveness disappear.

Electric Vehicles in Commonwealth Edison Service.

The accompanying panorama of electric vehicles will give some idea of the progress being made by modern transportation methods in Chicago. The greater part of the 69 electrics owned and operated by the Commonwealth Edison Company is here represented with the tall buildings of Chicago's lake front as a back ground.

One of the interesting features of the picture is that a number of the vehicles shown were included in the company's initial order, some ten years ago. They are still in active service. The first purchase of the electrics represented in the illustration, was made in January, 1909, when two 3,000-pound wagons of that type were purchased. Other installations followed rapidly.



Left-Hand Group of Electric Vehicles in Commonwealth Edison Service.

Capacities of the electrics at present used are as follows:

Capacity	Number
700 lb.	2
750 lb.	2
1,000 lb.	7
1,500 lb.	6
2,000 lb.	4
3,000 lb.	37
4,000 lb.	9
7,000 lb.	1
10,000 lb.	1

The lighter of the wagons are used by the lamp-renewal department, and also for customers' repair service. Those of medium weight are used by the lamp-renewal, supply, underground and overhead departments; one 3,000-pound wagon also serves the inside wiring department.

Three of the recently installed service wagons may be seen near the middle of the line. There were eight of these 3,000-pound special vehicles put in service only a short time ago. There are still a few horse-drawn vehicles in service, which will eventually be replaced.

The Value of Advertising.

A pretty good illustration of the advertising value of the Gas and Electric Building to Denver—"The City of Lights," was recently brought out in a story told by a local hotel man. A family of three, enroute East, stopped at his hostelry while in Denver, but for some strange reason did not see the Gas and Electric Building, which is the best lighted structure of its kind in the world.

On their way East the family stopped off in Colorado Springs and a friend asked how they liked the lighting on the Gas and Electric Building. They confessed they had not seen it and after their Colorado Springs friend told them how beautiful the structure was, they returned to Denver for the express purpose of seeing this palace of light. On coming back to Denver, the gentleman member of the party informed the hotel proporietor of his return mission and said he couldn't afford to go east and tell his friends he had not seen the Gas and Electric Building illumination.

The hotel man who related the story was very much impressed and explained that it was certainly ample proof of what a progressive corporation could do to aid in extensively advertising a city. The Gas and Electric Building is one of the show places of the city.

Instructions for Central-Station Salesmen.

The sales department of the Union Electric Light & Power Company, St. Louis, Mo., has inaugurated instruction classes for its employees with the view of increasing the knowledge and efficiency of the new-business getters. The course of instruction deals mainly with the company's rates and their application to various conditions likely to be encountered by the salesmen. There are three classes, a junior, intermediate and senior and each employee must pass suitable examinations before being advanced to a higher class, which also entails more responsible duties. Classes are held semi-monthly and attendance is compulsory.

New Vice-Presidents of Byllesby Company.

Three new vice-presidents were recently elected by H. M. Byllesby & Company. The new officers are George H. Harries, Elmert Dover and W. O. Johnson. General Harries has been connected with the Louisville Lighting Company and the Consumers Power Company, in Minnesota. Mr. Dover is president and manager of the Tacoma Gas Company and has general charge of the Pacific Coast properties. Mr. Johnson has recently joined the company as New York representative.

Use of Meters on Rural Lines.

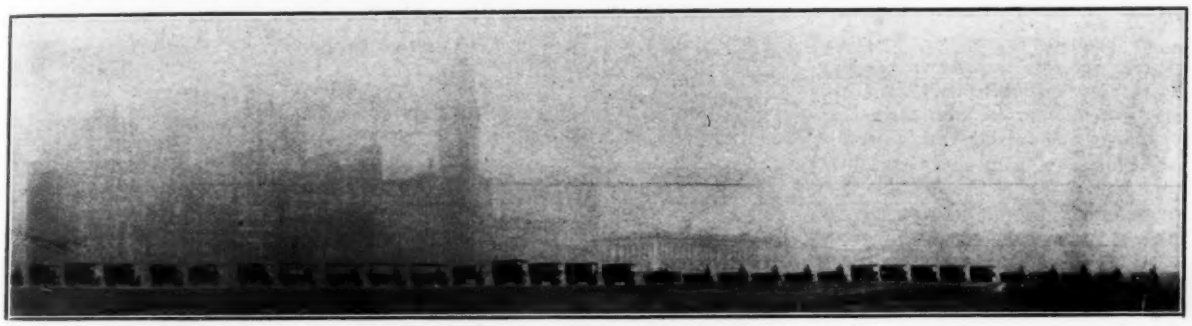
On many rural lines the use of power is largely concentrated at certain seasons of the year, while at others the consumption is quite small. When, however, the consumption is measured by means of a watt-hour meter, the energy loss in the potential coil continues uninterruptedly throughout the year. In an article in the *Elektrotechnische Zeitschrift,* H. Bueggeln calls attention to this and gives some figures indicating the undesirability of metering the consumption of such customers.

A good single-phase meter for 110 volts consumes at least one watt, and for 220 volts, at least 1.5 watts. In the course of a year this amounts to 8.76 kilowatt-hours and 13.14 kilowatt-hours respectively. On a three-phase circuit at 220 volts and 440 volts the losses amount to 3 and 4.5 watts respectively, or 26.28 and 39.42 kilowatt-hours per annum. In the case of one central station mentioned, where there are 2,652 lighting customers and 2,067 power customers, the total consumption per annum in the potential coils in the meters is 90,000 kilowatt-hours. As the current sold amounted to 1,166,000 kilowatt-hours, it will be seen that the loss amounts to about 7 per cent of the useful energy. If the cost of energy is 1.66 cents, this amounts to $1,500 per annum. The author advocates a flat rate for such customers.

Central-Station Men of Louisville Hold Luncheon.

Christmas was an occasion of no mean importance with the Louisville Lighting Company, of Louisville, Ky., a property owned by H. M. Byllesby & Company, of Chicago. A few days before the festive day, the company was host at a delightful luncheon given its officers and staff men together with those of the Louisville branch of the Federal Sign System (Electric). The luncheon was given at the Hotel Henry Watterson.

P. T. Glidden, general manager of the Louisville Lighting Company, responded to the call of Toastmaster A. T. Macdonald, sales manager of the same company, with a short speech in which he thanked the guests for the hearty, co-operative spirit which they have exhibited in working under his direction during the past year. In closing, Mr. Glidden extended the greetings of the season and was warmly applauded. G. Wilbur Hubley, chief engineer of the Louisville Lighting Company, and R. E. Brian, manager of the Louisville Federal branch, followed Mr. Glidden with speeches.



Right-Hand Group of Commonwealth Edison Vehicles.

New Branch Office for Union Electric.

Union Electric Light & Power Company, St. Louis, Mo., has found it necessary to open a branch office for the convenience of its patrons of the Northwestern portion of the city at 3028 North Grand Avenue, owing to rapidily increasing business. The new office will be conducted on the lines of the other branches at 49122 Delmar Avenue and 3012 South Grand Avenue, where bills may be paid. lamps purchased and exchanged, and applications for service made. A full line of electrical appliances such as irons, toasters, percolators, grills, vacuum cleaners, etc., will be carried in this new branch, which was opened on December 20. With three branch offices conveniently located in different portions of the city, the increased facilities should enable the company to handle its rapidly growing business expeditiously.

Electrical Construction

SOME UNUSUAL CONSTRUCTION IN APARTMENT-HOUSE WIRING.

Notes on a Job Which an Electrical Contractor Installed in His Own Building.

This paper undertakes to describe a part of the electrical work in a large, modern apartment house in Chicago which was installed by the owner of the building himself, who is a practical electrician and a leading electrical contractor.

The building is 172 feet long and 100 feet wide, and is three stories high. There are 25 apartments in it. It is constructed of brick, with terra cotta trimmings and marble vestibules.

The location is in one of the overhead-distribution sections of the Commonwealth Edison Company of Chicago, where alternating-current service is supplied. A three-wire service, designed to deliver about 500 amperes, is brought into the building from an alley in the rear, a two-inch service pipe being run up on the outside of the rear wall and terminating in the usual type of terminal fitting. The service switch is installed in a metal cabinet immediately at the point where the service conduit enters the basement. From this box the service is carried through a run of two-inch conduit to the cutout cabinet shown in Fig. 1. Here the circuit is split into three parts, one of which supplies current to a meter board for 12 apartments, another to a second meter board for 12 other apartments, while the third branch into which the circuit is divided feeds the lamps in the public hallways, those in the basement and those in the janitor's apartment. The three-pole knife switches in these respective circuits are shown in the figure, as are also the cutouts for the hallway, basement and janitor's lamps, the snap switches for controlling these lamps in convenient groups and the meter for measuring the energy consumed by them. It is worth while to note in passing that the current for the lamps mentioned is paid for by the landlord, and hence it was considered desirable to keep this meter separate from the groups of instruments used in metering the tenants' current.

Meters for the purpose last mentioned are arranged on two separate boards, in different basement rooms, there being 12 watt-hour meters on each one of these two boards. One of the three one-inch conduits shown in the upper left-hand part of Fig. 1 connects the cabinet seen in this photograph with one of these meter boards, and another one of these pipes carries a circuit to the other group of tenants' meters. The tenants' meter board nearest the service entrance is shown in Fig. 2, and this figure also shows the method of grounding the conduits rather well and how junction boxes are employed in branching off from one run of conduit to another. A short ground wire extends from the last junction box in the figure to one of the four large pipes running parallel along the ceiling of the basement, as may easily be seen. Grounding is equally thoroughly done throughout the entire installation.

Fig. 1.—First Junction Cabinet.

The other board for tenants' meters is shown in Fig. 3, this being practically a duplicate of the board shown in Fig. 2. A matter of special interest in connection with these two boards is the fact that a separate cutout cabinet is provided for each tenant. As electricians know, it is a practice which is quite common in the wiring of apartment houses to install the cutouts for a number of apartments in one large cabinet. This construction is open to the objection that it may be quite difficult to locate the circuits of any particular apartment after the wiring has been finished, and that the finding of a blown fuse may not be so easy as might be desired. Where there is plenty of room for meter boards, the arrangement employed in the installation under consideration here has much to commend it. In an installation of this kind it would be no difficult matter to provide a lock for each separate cutout cabinet, and so make it impossible for any person but the tenant himself to interfere with the service to any particular apartment.

One of the newest things about the method of installing meters employed here is the use of a standard watt-meter box in each meter loop. This sort of construction was adopted because it is a good one and in order to conform to requirements lately incorporated in the construction rules of the bureau of electrical inspection of the city of Chicago. The wattmeter box, which is manufactured by the Appleton Electric Company, of Chicago, contains a porcelain terminal block, to one set of binding-posts on which the electrical contractor runs his part of the meter loop when he is wiring the building. From the other set of binding-posts on this block the man who installs the meter runs the wires to the instrument itself. The meter

wires pass out through holes in a piece of porcelain set in one side of the box, and when the meter has been connected up, the cover of the box is sealed on by means of lead seals like those commonly used in sealing meters. When a meter is to be removed the seals are broken and the wires from box to meter are taken away, after which the cover is replaced and the closing up of the wattmeter box made complete by slipping a metal cover over the porcelain block through which the outlets for the meter wires are. In Fig. 5 one of these boxes sealed up completely is shown, as are also the side cover and the porcelain terminal block.

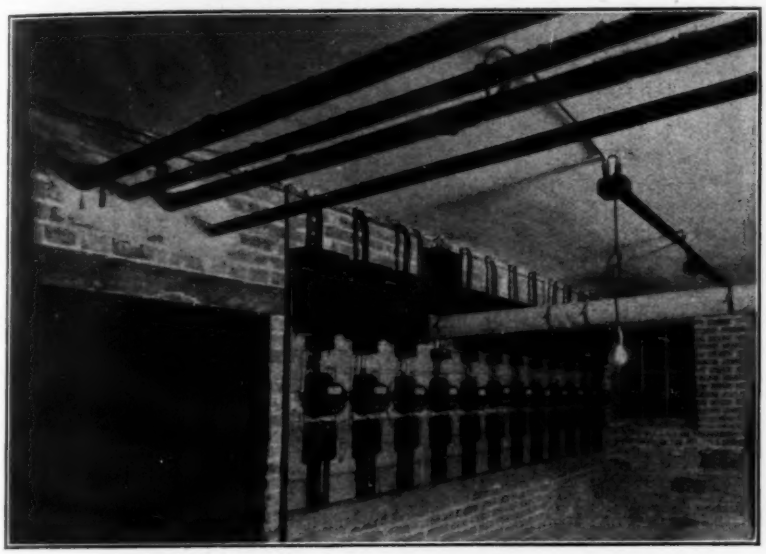


Fig. 2.—Meter Board and Circuits from Junction Cabinet.

Fig. 4 is a diagram of the connections to the meter, and it also shows how the circuits are taken from the service to the apartments in the building in question. The individual cutout cabinets are connected by means of short lengths of one-inch conduit, and through these, from one side of the meter board to the other, a three-wire circuit is run and the services for the apartments are tapped off, as shown in the figure, opposite sides of the three-wire feed being tapped in adjacent cabinets. In the cabinet shown in Fig. 4 current is carried from the lower outside wire to the wattmeter box, and from here through the demand indicator; then through the series coil of the wattmeter and up to the service cutout. From the middle wire the pressure tap is run to the meter, passing first to one of the meter fuses and through the terminal box described above. At the meter cutout a wire is tapped off for supplying the opposite side of the circuits to the apartment served from this cabinet. There are four circuits to each apartment in the building.

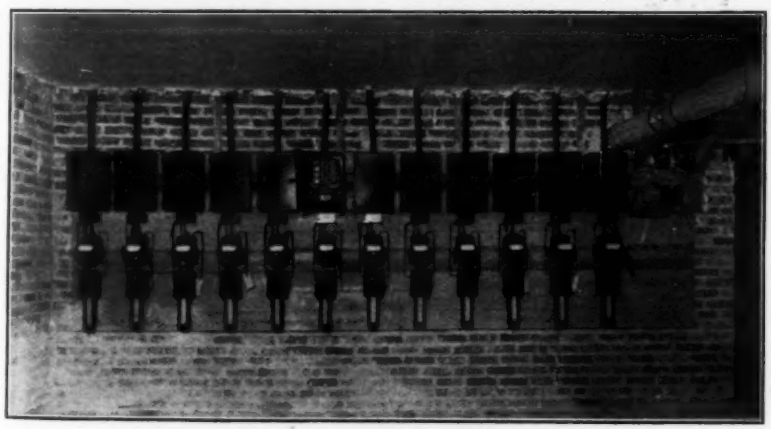


Fig. 3.—Second Meter Board.

In the right side of Fig. 3 the bell-ringing transformer which supplies low-voltage current to all bell circuits in the building is shown. From this transformer current is also supplied for operating the electromagnetic door-openers with which each one of the four front doors is equipped, and for ringing circuits of 33 house telephones.

It should be noted that in this building no speaking tubes at all are used; telephones take the place of them throughout all the rooms and to all doorways where speaking tubes would ordinarily be run. The telephones are of the flush type, and those in the vestibules are set in bronze frames. In the apartments the telephones have push-buttons for signaling the four laundries in the building and for operating the door-openers.

In place of the gas logs so often installed in the open fireplaces in living rooms, electric luminous radiators are used in these apartments. Moreover, the radiator is so arranged that standard lighting units of any desired color may be readily substituted for the radiator lamps, and a pleasing lighting effect produced, in case the tenant prefers light rather than heat from this source.

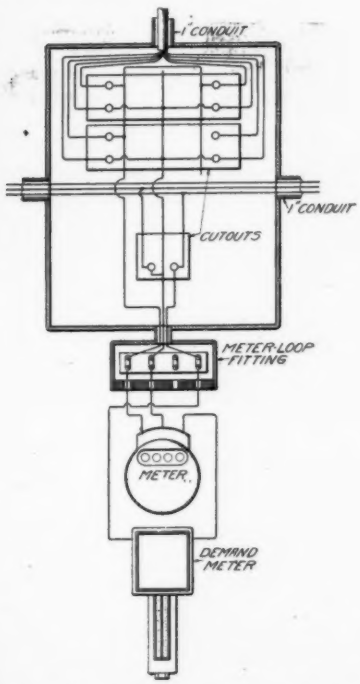


Fig. 4.—Wiring to Meter and to Cutouts.

High-candlepower tungsten lamps are installed on all back porches for lighting these and the approaches to them thoroughly. The owner of the property stated that without such a provision as this it was very hard to get the deliverymen of merchants and others to carry goods to the rear of the building. If the lighting on the rear porches is not good, these men insist on coming to the front doors

when goods must be delivered in the evening.

Outside each front vestibule a small bracket lamp is installed, and on the vertical sides of the shades of these the door numbers are placed. The vestibules are unusually well lighted, there being special lamps on bracket fixtures for illuminating the letter boxes.

It should be mentioned in conclusion that tenants in these apartments are furnished free electric-vacuum cleaner service. In the basement of the building there is a five-horsepower, single-phase motor driving a cleaner which supplies a vacuum to all apartments for cleaning.

The owner of this building is W. J. McKillip, who, besides installing the electrical work, had general supervision of the design and other construction details.

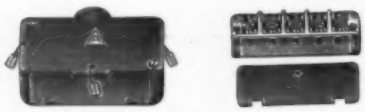


Fig. 5.—Meter Box Sealed Up, Porcelain Terminal Block and Side Cover.

Meeting of Chicago Contractors.

The Chicago members of the National Electrical Contractors' Association held their regular monthly rally for December on December 18, at the Grand Pacific Hotel. Beginning at 6 p. m., there was a banquet, during which the banqueters enjoyed the additional treat of listening to some splendid music. At the conclusion of the banquet, F. L. Decker, of Chicago, delivered a stereopticon lecture on the "Book-keeping System of the Illinois Electrical Contractors' Association," which was described in preceding issues of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN. After the lecture there was a general discussion of the system explained by Mr. Decker, and also a talk on the importance of systematic methods of accounting, by F. M. Kane, who is an expert accountant.

Like all of the rallies, the Chicago contractors hold, this meeting was a mighty pleasant one, and the talks and discussion of the evening were most interesting and helpful.

A Poor Sort of Door Switch.

A local contractor tells of an installation in which an ordinary latch was used as a switch for controlling the incandescent lamp in a basement room. The latch was inserted in one leg of the circuit so that when it was lifted the current was cut off from the lamp. Fortunately for the genius who was using this contrivance, the latch was in the neutral wire of a three-wire circuit instead of in an outside conductor, for the floor was wet and the neutral was grounded.

The Esthetics of Electric Wiring.

Nowadays architects and owners—to say nothing of those who only rent houses and apartments—demand that the lighting arrangements shall have a certain amount of esthetic beauty as well as convenience; and among the points on which they insist is that the conductors for the electric lights shall not be too conspicuous.

Into this matter A. Neuburger has gone quite thoroughly; and his remarks on the subject, in a paper read before one of the German technical societies, should be interesting to our readers.

Fig. 1.—Circuit in Which Short Cut is Taken.

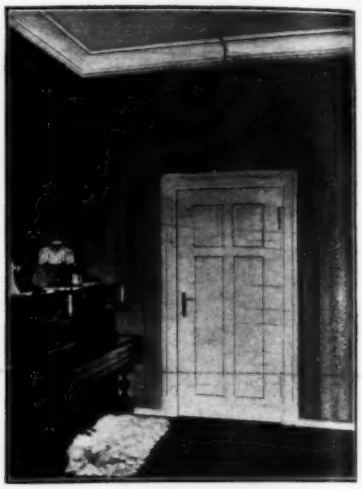


Fig. 2.—Better Way of Running Circuit.

Fig. 3.—Another Short Cut.

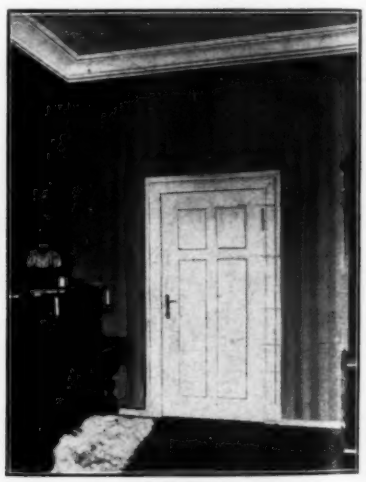


Fig. 4.—Effect Obtained by Following Floor Line.

Among other remarks he calls attention to the fact that in new buildings the electric conductors are laid in the walls themselves, as was formerly the case with gas pipes. The plastering and papering cover them, so that they are not offensive. But where electric lights are installed in old buildings, the case is different; the wires must often be run on the surface of the walls and ceiling. No one can assert that they add to the beauty of the rooms. In some cities there are regulations that all wires shall be inclosed in conduit, but in other places it is permissible to run them on porcelain knobs. Neither the pipes nor the knobs are things of beauty and joys forever. The pipes may be painted the same shade as the wall paper, and the wires may be covered with silk of the same color, but the knobs remain very visible to the unaided eye. As for the conductors, the longer they are there, the worse they become; they catch dust that cannot be brushed off with a soft brush; and a hard one scratches off the paint and injures the insulation of the circuit.

Where the wires are run along a white ceiling, a black streak soon appears on the latter. Newly whitewashing is not admissible, as the moisture would injure the insulation and cause short-circuiting.

Besides this, the men who lay the lines have, as a rule, but very little taste. They often think "the nearest way is the best" and spoil the appearance of the room unnecessarily.

More recently there has been brought out a system of light lead-covered cables, and these take up less room and look better than the separate pipes. Brass tubes are sometimes used and look more like a gilt molding; the cable with lead covering may be easily painted the color of the papering.

As regards taste in running the line, Fig. 1 shows the result of "taking the short cut"; Fig. 2 is an improvement, as some of the architectural lines are followed. Fig. 3 is another example of "short cut," and Fig. 4 shows the improvement resulting from following the floor line and then running upwards.

Care of Direct-Current Switchboards.

The proper treatment of switchboards is a matter which ought to be of interest to most electricians. Writing on this subject in a recent issue of *Power*, G. B. Longstreet says that the switchboard should be located in a dry place and well insulated. If there are windows near it, they require careful watching in stormy weather. The board should be kept clean and neat bright to make good contact, and should work freely. A very small amount of vaseline applied occasionally to the blades will allow them to close easily and will not interfere with good contact.

Automatic circuit-breakers require considerable attention. They must work freely and accurately and both the carbon and the copper contacts should be examined frequently, especially after bad blowouts, to make sure that good contact is made and that there are no badly burned or blistered parts. If there are, the parts should be replaced.

Rheostats must also receive a like both in front and back, and enough room provided in the rear to allow a person to work freely without coming in contact with any wire or busbar.

If a compressed air blast is to be had this should be used occasionally for blowing the dust from the board, a light blast being used without a metal nozzle attached to the hose. Where this is not obtainable the work can be done with hand blowers.

It is best to put the name of each circuit on a card and place this directly over the switch controlling that circuit. Receptacles made expressly for receiving these cards can be purchased at a small cost, also one or more drawings of the switchboard and connections are a help to the attendant at all times, and on large or complicated boards these are a necessity.

The switch blades should be kept amount of attention. A good contact must be maintained between the movable finger and buttons or bars, as the case may be. A small amount of vaseline applied to them gives free movement without impairing contact. In the case of bar contacts special care should be taken that the intervening spaces do not fill with dirt.

Voltage regulators should receive attention according to the directions furnished by the makers. All meters should be calibrated at regular intervals and if found incorrect should be corrected. Busbars should be marked "positive" and "negative."

In plants where the service cannot be suspended to make repairs to circuit-breakers or switches, a jumper may be used. This is made of cable with a forked terminal soldered to each end. Before pulling the switch or circuit-breaker one end of the jumper should be fastened to the switch-post of the out-going cable and the other end connected to the switch-post of the out-going cable of the circuit chosen to take care of the load during repairs. Where possible it is preferable to do this when the load is light, but if this is impossible care should be taken to choose a strongly fused circuit upon which to tap. A good policy is to have an extra switch or circuit-breaker to be used for this purpose only.

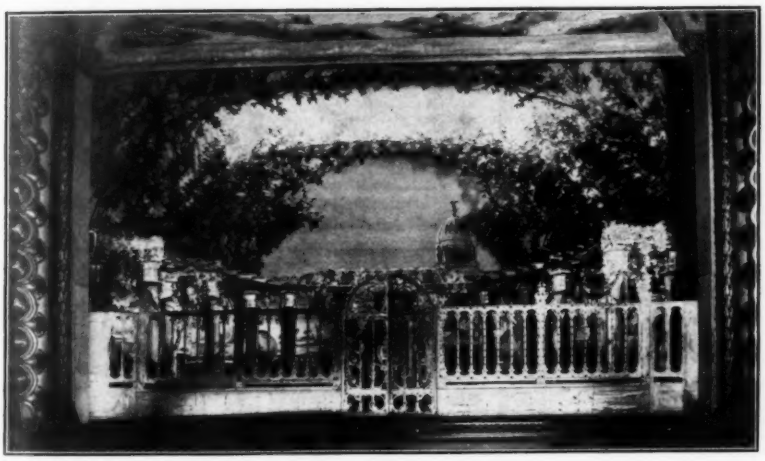


Fig. 1.—Fence and Gate.

An Interesting Installation of Theater Wiring.

Electric wiring for supplying current to lamps or other apparatus used on the stage in a theater has usually to be installed to meet very exacting conditions. It must be installed so that under normal conditions there can be no failure or even temporary interruption of the service, and it must be absolutely safe. Where apparatus is to be moved from one town to another, as is frequently the case, the wiring on it must be designed to withstand this without injury and without requiring excessive room. Furthermore, if the circuits on any appliance are to be in view of the audience during a performance, care must usually be taken that they are not unsightly. Explanations of how such conditions as these are met often contain suggestions valuable to men engaged in other kinds of electrical construction, in addition to their interest to men doing only theater work.

The wiring with which this brief paper is concerned is used to supply current to the lamps on a fence and gate which, during one of the acts, extends entirely across the front of the stage in the La Salle Opera House, one of the large theaters of Chicago. The play, which is entitled "The Girl at the Gate," was on the road for time, and the fence and gate shown in Fig. 1, with its lamps and circuits, and the storage batteries used as the source of current, was shipped around with the rest of the property of the play. The total length of the fence and gate is about 40 feet, and it is 8 feet high, the gate itself being in the center of the stage. On the fence and gate there are 612 round-bulb, tipless miniature Mazda lamps, the bulbs of all of which are colored amber. An idea of how the lamps are distributed may be obtained from the photograph, in which they appear as small dark spots, the lamps not having been burning when the photograph was taken. They are all six-volt lamps, and some of them are of the two-candlepower size and others three. The current required to operate them is 300 amperes, and this is supplied from two batteries of Edison storage cells, one battery carrying one-half of the load and the other the other half. Each battery consists of six cells, connected in series and incased in a wooden case provided with cover and handles to make it con-

venient to move the batteries around. Each battery weighs about 125 pounds.

The lamps are divided up into 38 circuits, all lamps being connected in multiple, and every individual circuit is protected by Edison plug fuses installed on the fence. All fuses are inclosed in a galvanized iron box running along the bottom of the fence throughout its length. Where the fuses are, the cover of the box is hinged so that box can be readily opened here.

No wires whatever are used on gate or fence, except for making splices, the use of wires here being impracticable because of their unsightliness and because of the liability of injury in service of this kind. A rather accurate notion of just how the lamps and the circuits for them are installed may be obtained from a study of Figs. 2 and 3, Fig. 2 being a rough drawing of that part of the fence extending from one side of the stage to the gate, and Fig. 3 a cross-sectional view of the fence.

The lamp sockets are installed in busbars made of narrow strips of sheet copper. The fence and gate are constructed of quarter-inch profile board. Where a row of lamps is installed there is a busbar on either side of the fence, and these are exactly opposite each other. The bar on the front side is half an inch or so in width and that on the back about half as wide. There are holes in each front bus large enough for the lamp socket, and the rear bar has holes through it just large enough to take the small pin which projects from the base of the socket. This pin, it should be noted, forms one terminal of the circuit at the lamp, and the shell of the socket the other. As is shown in Fig. 3, both shell and pin are soldered in place, so as to make the electrical connection good.

All busbars are painted thoroughly with a high grade of insulating varnish.

In Fig. 3 the iron box which contains the cutouts is shown, in section, also. For the sake of clearness both the positive and the negative fuses are both indicated in the figure, although in an accurately drawn view like this but one fuse would be shown, of course.

Current is brought from the storage batteries by means of stage cables, slip connectors being used to connect at the end of the fence. For making connection in the circuit from fence to gate short lengths of flexible cable and slip connectors are made use of.

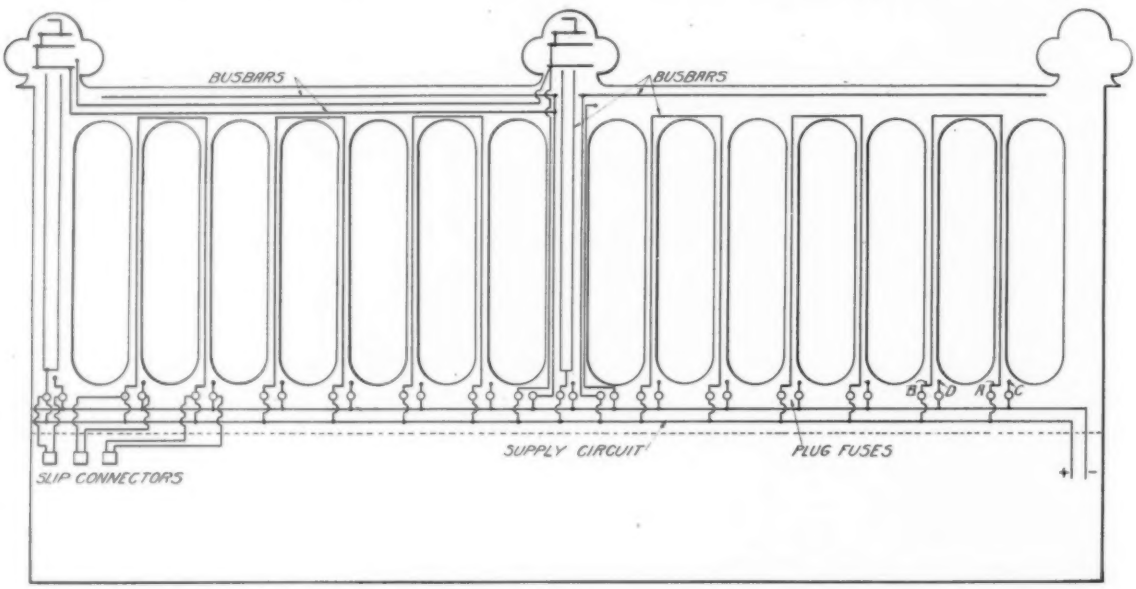


Fig. 2.—Arrangement of Circuits on Part of Fence.

The location of some of the busbars in which the lamp sockets are set is indicated in Fig. 2, and by means of this diagram the path of the current through some of the lamps can be readily traced, although the positions of the lamps are not marked in this figure. For example, assuming the polarity to be that shown, the path of the current would be from point *A* to one of the bars on the rear of the board; then through the lamps to the bus on the front of the board, and back to the storage battery by way of points *C* and *D*.

The electrical work on this gate was designed and installed by Roscoe E. Major, chief electrician at the La Salle Opera House, to whom acknowledgments are due for assistance in collecting the foregoing data. The lamps and the material he used were supplied by the General Electric Company.

RUNNING A DIFFICULT CIRCUIT.

By A. Whitman.

Not long ago I was called upon to wire a cellar in an old three-story house, where I found it extremely hard to discover a means of running the feed wires to the cellar without tearing up a considerable quantity of double flooring. Finally I hit upon the following expedient, which proved to be satisfactory.

I took a few pieces of quarter-inch pipe and, after boring a hole through the first ceiling-joist plate in the attic, I stuck a seven-eighths-inch bit in one end of the pipe, flattening the latter out so that bit would not slip, and then, with the brace on the other end of the pipe, I bored through the second joist plate. Then I added a sleeve and another piece of pipe, and bored through the third or bottom plate in the partition.

Two sets of holes were bored in this way, one for each wire, and the pipes left in place to serve as conduits for the conductors, which were run through them to feed the cellar lights from the attic. Since the supply consisted of direct-current power it was all right to run these wires in separate tubes. Moreover, it was not deemed a violation of the spirit of the Code to use quarter-inch iron pipe, this being about the best construction possible.

Minnesota Contractors to Meet.

The Minnesota State Electrical Contractors' Association will meet in the Builders Exchange, St. Paul, Minn., on February 1, 1913.

Tungsten Bunch Lights.

At the La Salle Opera House, Chicago, arc lamps for lighting drops at the back of the stage have been replaced by so-called tungsten bunch lights, which Roscoe E. Major, the chief electrician at this theater designed. Each unit consists of four 250-watt, 110-volt tungsten lamps, connected in multiple and installed in a galvanized-iron box, the box being mounted on a portable stand of the proper height to bring the lamps into the best position for lighting up the drop properly. The box is made of 20-gauge iron, and its dimensions are 14 by 23 by 7 inches. It is painted inside with aluminum paint. Any standard color frame fits it nicely.

When a colored light is wanted on

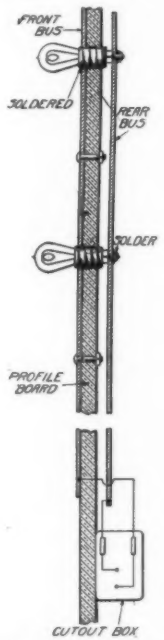


Fig. 3.—Cross-Section Showing How Lamp Sockets are Attached to Busbars and How Circuit is Connected.

the drop or curtain, one of the color frames referred to is inserted in the box.

This sort of lighting unit has been found very serviceable not only for lighting the part of the stage equipment just mentioned, but for the illumination of entrances to the stage as well. It does not require the services of an attendant, and is free from noisiness.

Among the Contractors.

An electrical contract for the wiring and motor installation in H. J. Guthrie's new sanatarium in Franklin, Ky., has been secured by W. H. Isbell, a prominent electrical contractor of Bowling Green, Ky. The work in the Franklin institution will cost about $1,000.

The Richardson Electric Company has secured the contract for the electrical work on the new Curling Club Building in Duluth, Minn. This is a $150,000 building now being erected.

William Wiggins will enter into the electrical contracting business with offices at 4003 Ludlow Street, Philadelphia, Pa.

The rumor that Lawrence A. Blum had secured the contract for wiring the carriage repository and garage for Robert Kinnier in Baltimore, Md., was incorrect, as Joseph A. Becker was successful in securing this contract, which is quite a large one.

The Pierce Electric Company, of Chicago, is installing the circuits for 800 incandescent lamps, 15 arc lamps, and a number of motors in a building to be used by the Empress Theater Company, in Chicago.

Kingsbury-Samuel Electric Company, one of the pioneers of the electrical business in Baltimore, Md., was awarded the contract for the electrical installation in the Whiteford Hall for the St. Joseph's Monastery.

A contract for installing an ornamental street lighting system along Main and St. Clair Streets in Frankfort, Ky., has been closed by the Harry I. Wood Company, of Louisville.

The Electric Equipment Company, of 104 North Fifth Street, Reading, Pa., has the contract for wiring the new Griscom store and office building, on which work is about completed.

The Farnsworth Electric Company, of Bowling Green, Ky., is the newest concern in the contracting trade of Warren County. The company has established commodious headquarters on Main street in Bowling Green and is prepared to do big business in an exceedingly rich section of the state.

The Consolidated Electric Company, of Nashville, Tenn., recently met with involuntary bankruptcy proceedings instituted against it by its creditors, the chief of these being the Southern Electric Company. The schedule of assets and liabilities filed by the concern in response shows the former to be $1,200, while the latter aggregate $3,021.77.

The Marine Electric Company, of Louisville, Ky., has contracted to overhaul extensive electrical equipment, including wiring, motor installation, and lamp and search-light appliances, on the tow-boat *Sprague*, which is tied up at the Gateway City wharf for repairs. The *Sprague* is the biggest afloat on the Ohio, and is engaged in the coal traffic from Pittsburgh to Cairo and lower Mississippi points. She is a thoroughly modern boat, is equipped with electric lights stem to stern, as well as smaller motor apparatus and signal system.

The firm of Bond Brothers, of Evanston, Ill., of which firm Ignatius Bond and Max Lehman are the managers, are installing the electrical work in a new residence building which N. A. Williams is erecting in that city. This will be one of the largest and most modern residences in Evanston.

The Starling T. Yeager Electric Company, of Owensboro, Ky., has just completed the installation of a modern street-lighting system along Main street in Owensboro and is to provide the equipment for thorough illumination of the courthouse square. Additional contracts landed by the Yeager concern are those for complete wiring in the new Masonic Temple, the residence of Bailey Clark and the warehouse of the Owensboro Tobacco Company. The company anticipates in 1913 the biggest business year it has ever known.

The December 18 issue of *The Morning Herald*, of Durham, N. C., contained nearly a column of matter descriptive of the Christmas display at the store of P. T. Elliott, a prominent electrical contractor of that city. Mr. Elliott made a feature display of electrical toys, Christmas-tree lighting, and the like, at his holiday opening. On the night of this opening—December 18—an additional attraction at the store was a well-arranged and well-rendered musical program, in which some of the best singers in the city participated.

What seems to be an unusually clever advertising scheme is one which the George Weiderman Electric Company, electrical engineers and contractors, having offices at 35-37 Rose Street, New York, and 191 Flatbush Avenue, Brooklyn, is making use of. It consists of a cardboard folder bearing an announcement of the company's business and locations and containing ten splendid testimonials from prominent patrons whom the company has served. When folded up ready for mailing the folder is about the size of an ordinary postal card. On the outer front side of the folded card is the sentence, "What they say about us", and room for the one-cent stamp necessary for postage and the address. This sort of advertising should prove highly effective, it would seem.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

An Electrician's Call Signal.

In a large plant or in an office building where the electrician is often away from his shop doing repair work, it is necessary for him to have a signal arranged so that, if the master mechanic or office calls him on the telephone in his absence he will know it on his return to the shop. The one I use is made from a drop-type annunciator in circuit with the telephone from the superintendent's office. When he calls it drops the number and thus closes a circuit that lights a red lamp. By pushing the plunger or set button on the annunciator, it is reset. I placed the annunciator beside the telephone, so that when I answer the call it is handy.

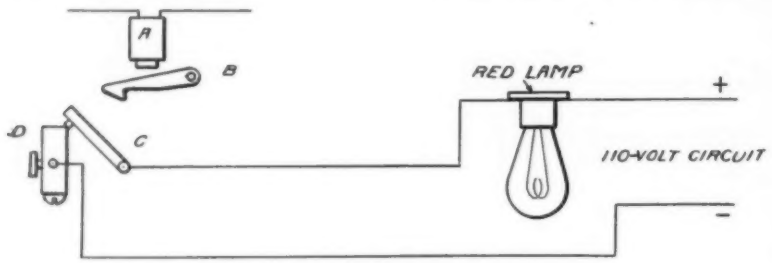


Fig. 1.—Circuit of Signal Lamp.

The arrangement of circuits is as in Fig. 1. When the telephone or push button closes the circuit of the annunciator the magnet *A* (Fig. 1) lifts latch *B* and allows drop *C* to touch binding post and contact *D*, which closes the signal-lamp circuit.

If the proper sort of annunciator cannot be procured, the necessary signal can be constructed from the parts of an old electric bell.

Ben R. Browne.

Plugging Ends of Conduits.

I find that the knockouts from outlet boxes are just the thing for closing up the ends of conduits and keeping them closed from the time they are installed until the wires are to be drawn into them. In using these, you proceed by taking off the bushing from the exposed end of the pipe, slipping a knockout disk of the proper size into it and then screwing the bushing back into place. I find this way of stopping up the pipes far better than using wooden plugs and the like. Frank Scott.

Fastening Fixture Studs.

In hanging some fixtures a few days ago I came across a job where the electrician had neglected to put the fixture studs in the outlet boxes. Moreover, there was nothing back of the boxes near enough to be used as supports for the studs. The conduit being introduced from the sides of the boxes, I removed the center knockout and, by means of a piece of wire, fished the bolts provided to hold fixture studs through the knockout hole, and dropped them into the holes made for them in the bottom of the box, leaving the heads up outside the outlet box. Then I locked the studs on with the locknuts, pulling downward hard on them while tightening the nuts. Thus the studs were set as firmly as if they had been installed in the regular way. William Foy.

Drilling Slate Panels.

In drilling a slate panel one inch thick for front connected switches I found a good way to limit the depth of the holes drilled in the back to counter-sink the screw heads. A drill one-half inch in diameter was used, and over this was slipped a short piece of five-eighths-inch fixture tubing, the tubing being cut long enough to fit against the chuck of the brace or breast drill and leave just enough of the drill exposed to properly cut in for counter-sink. The tubing over the drill prevents the holes from being cut too deep and makes them all uniform so that the fastening screws will fit nicely. H. M. Pauley.

Hanging Drop Lamps From a Roof Structure.

While the idea is a very simple one and, to many readers, contains no new suggestion, the scheme of hanging drop lamps indicated in Fig. 2 is well worth knowing by everybody who does electric wiring, and hence it is put down here for the benefit of any wireman who may not have come across it before.

When incandescent lamps are to be hung on drop cords, it is usually desirable to get all the lamps in any room just the same height from the floor. The simplest way to do this in hanging lamps from a slanting ceiling or from the underside of an inclined roof is to make a mark on the step ladder the distance from the floor that it is desired that the lamps hang and use the ladder as a measuring stick. It's a good way to save time.

Charles J. Lendman.

Novel Elevator Signaling.

A novelty in the matter of signaling passenger elevators at floors where passengers are waiting is to be tried out in one of Chicago's large stores, it is said. The push button is to be discarded and instead an electrical contact mat will be laid in front of each elevator doorway on every floor. The matting is constructed so that when a person steps upon it an electrical circuit is closed, just as when a push button is pressed.

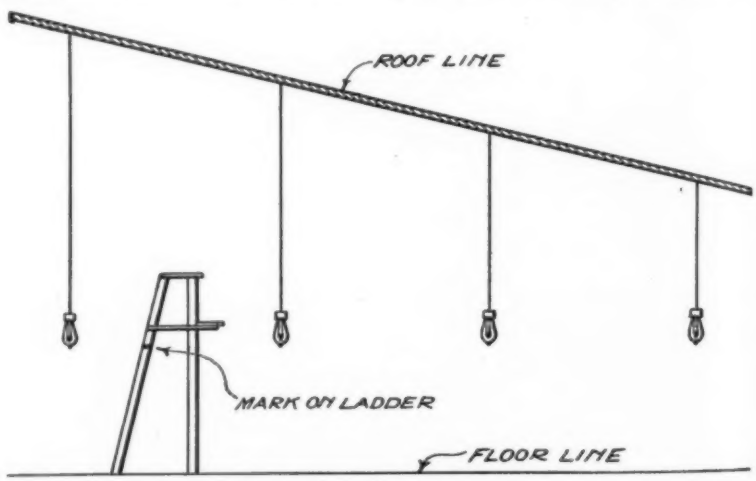


Fig. 2.—Marker for Lamp Height.

Public Service Commissions

CALIFORNIA.

A decision has been rendered by the Railroad Commission granting permission to the Sierra & San Francisco Power Company to purchase the Gold Mountain Water Company, of Sonora, Tuolumne County, for $27,500.

L. W. Warmoth was granted permission to sell his telephone system in Tehama and Glenn Counties to the Pacific Telephone & Telegraph Company for $4,500.

A decision was rendered granting permission to the Coalinga Water & Electric Company to transfer its control of the Russel-Robinson Water & Electric Company, of Arroyo Grande, to the Midland Gas & Electric Company, which operates in San Luis Obispo and Santa Maria.

A decision was rendered granting the application of the San Francisco-Oakland Terminal Railways for a certificate of public convenience and necessity to exercise franchise rights in Berkeley for the operation of a street railway on Eunice Street, Berkeley.

The Commission has adopted an annual report form to be used by all electric, gas, water and telephone companies.

OHIO.

The Public Service Commission has authorized the Dayton Power & Light Company to issue six-per-cent, cumulative preferred capital stock of the par value of $149,750 and to purchase outstanding bonds of the Xenia Gas & Electric Company, in payment for which the stock is to be issued.

The Dayton & Troy Electric Railway Company has been authorized to issue its five-per-cent preferred capital stock of the par value of $300,000.

The Miami Light, Heat & Power Company and the Piqua Electric Company have been authorized to consolidate and convert the stock of the constituent companies into stock of the consolidated company. The consolidated company will be known as the Miami Light, Heat & Power Company.

NEW YORK.

By adopting an opinion rendered by Commissioner Milo R. Maltbie, the Public Service Commission for the First District declared illegal certain contracts made by the New York Edison Company with Gimbel Brothers and the Broadway Realty Company. The C mmission holds that the Edison Company has violated the law against discrimination in rates by selling current under the two contracts at lower rates than were available to the general public according to its published schedules and contracts. The Commission took no further action at this time, accepting Commissioner Maltbie's recommendation "that a reasonable amount of time be allowed the Edison Company to advise the Commission what course it will pursue in the light of the findings and principles herein set forth." The opinion was rendered after hearings on the complaint of George Stadtlander and others against the New York Edison Company and the complaint of Julius Ewoldt and others against the New York Edison Company. The complainants asserted that the arrangements made between the New York Edison Company and the parties named were discriminatory and in violation of the Public Service Commissions Law. It was also alleged that the company had violated the order of the Commission requiring the publication of its rate schedules and forms of contracts. In the case of the contract with Gimbel Brothers the Commission finds that the Edison Company has been supplying that firm with electric current, for its department store at Sixth Avenue and 33rd Street, for a net cost of 2.25 cents per kilowatt-hour, when the published rate for such service was not less than 3 cents. This was accomplished by two contracts, in one of which the company agreed to supply electric current, in excess of a certain amount annually, for 3 cents per kilowatt-hour, and in the other the Edison Company agreed to rent from the firm space in its basement for a substation and to pay therefor as rental, the difference between 2.25 cents per kilowatt-hour and the price charged under the other contract for electricity. "In the present case," says the opinion, " the rental provision is not only unreasonable, but the method of computing the rental, the terms of the agreements and the method of accounting thereunder, are such as to convince the Commission that the whole arrangement is illegal and has been from the beginning." The Edison Company, it is held, should have contracted to pay the market value of the space rented, "leaving the customer to pay the lawful rate for the current consumed; i. e., the rate paid by every consumer of the same class." The making of the rental dependent upon the quantity of current consumed in one building "could hardly fail to result in actual discrimination during some part, if not during the whole, of the time covered by the lease." Similar findings were made in the case of the Broadway Realty Company, which made a contract March 10, 1904, with the New York Edison Company to supply electric current for the Bowling Green Building. This contract also covered the use of certain space in the basement of that building by the Edison Company for certain equipment.

The Commission has issued an order authorizing the Kings County Electric Light and Power Company to issue $2,500,000 of six-per-cent debenture bonds to be dated March 1, 1913, and convertible at par into the stock of the company at the option of the holders three years after date and payable 12 years after that date; also authorizing the issue by the Edison Electric Illuminating Company of Brooklyn to the Kings County Electric Light and Power Company of $2,200,000 face value of demand notes without interest.

Counsel to the Commission has been directed to prepare a form of amendment to the Public Service Commissions Law for presentation to the Legislature, giving jurisdiction over telephones and telegraphs within the First District to that Commission. The First District embraces the territory within the boundaries of Greater New York, and while it exercises control over railroads, gas and electric companies in that territory, the jurisdiction over telephones and telegraphs within the city is vested in the Commission for the Second District. The First District commissioners feel that all corporations subject to regulation within the First District should be placed under the jurisdiction of the Commission for that district.

The Public Service Commission, Second District, has authorized the Heuvelton Telephone Company to issue its common capital stock to the total par value of $14,000, the proceeds to be used for the acquisition of the telephone lines owned by Webster L. Wainwright at Heuvelton.

Advice has been received by the commission from the Utica Home Telephone Company that on December 7, 1912, pursuant to authority from the commission, it sold and conveyed all its physical property and business to the New York Telephone Company for the sum of $250,000 and the assumption of the payment by the latter company of $463,100 outstanding bonds.

The commission has made an order requiring the New York Telephone Company to extend before January 1, 1913, its Far Rockaway free-mileage-area limits to the eastward. The remaining portion of the present Cedarhurst exchange area shall constitute a separate exchange area.

Among the Supply Men

B. B. Downs, president St. Paul Electric Company, St. Paul, Minn., reports business exceptionally good for the month of December.

The Northern Electrical Company, Duluth, Minn., is making a special campaign on lamps, electric irons, electrical toys, holiday specialties, electric fixtures and portables. Local business is unusually good. A. W. Lindgren, business manager of the company, has returned from a trip following his attendance at the meeting of the Jobber's Association at Hot Springs, Va. H. W. Irwin, formerly of the Irwin Electric Company, South Carolina, is now in charge of the Northern Company's retail department. P. D. Rensenhouse, formerly manager of Cassopolis Light & Milling Company, Cassopolis, Mich., is in charge of the fixture department. A. L. Foster has lately assumed the position of superintendent of construction.

The Interstate Electric Company, Ltd., New Orleans, La., states that sales on electrical heating appliances are excellent, manufacturers' advertising having created a big demand. The company will hold a sales conference December 30, 1912, to January 4, 1913.

Shepherd-Fluharty Electric Company, one of the most enterprising electrical jobbers of Baltimore, Md., report that never before has their business been so good as that of the past month in comparison with the business at the same season in previous years.

The sales organization of the Interstate Electric & Manufacturing Company, Sioux City, and the Joseph R. Lehmer Company, Omaha, affiliated companies, will hold a sales conference at Omaha, January 7 to 12. The manufacturers represented by these companies will give talks to the salesmen on their various lines.

Woodward, Wight & Company, Limited, New Orleans, La., is making a specialty of electric light and power plants, reporting, incidentally, great activity in flat irons, apparatus and lamps. C. B. Mahaffey, formerly supply manager of the New Orleans office of the General Electric Company, is now manager of the Woodward-Wight electrical department. Frank D. Ledig is assistant manager.

C. E. Browne, president of the American Electrical Supply Company, Chicago, Ill., reports the demand in all territories for general supplies good. The company will probably hold a sales convention soon after the first of the year.

The H. W. Johns-Manville Company has appointed C. S. Berry manager of its Atlanta, Ga., office. This office carries a full line of Johns-Manville products, facilitating deliveries in the South. The office also employs a force of men experienced in the application of J.-M. products.

The Monarch Electric & Wire Company, Chicago, Ill., states that its campaign in Monarch special brand weatherproof copper and iron wire has developed a large volume of business and its production has been taken as fast as it could be made. The company also reports many orders for galvanized strand.

The Mills Electric Company, Peoria, Ill., has employed a new salesman to take care of increasing business in Iowa. George F. Sonneman will cover the northern half of Iowa, and Ralph V. Miller will cover the southern part of Iowa and a portion of Missouri.

The Commercial Electrical Supply Company, St. Louis, Mo., is conducting a special sales campaign on the Commercial wire-drawn tungsten lamp, including standard and miniature sizes. The company states that it has signed up over 100 contracts in the last ten days, and expects to do a business during 1913 of a million lamps.

Elliott Lum, formerly with the Western Electric Company at Minneapolis, and later in the contracting business at Miles City, Mont., has accepted a position with the Western Electric Company at Omaha, Neb. He will travel Iowa, making headquarters at Sioux City.

The Northwestern Electrical Equipment Company, St. Paul, Minn., has wound up a very successful campaign on Christmas sales of Hot-Point electric heating devices. J. M. Hannaford, general manager of the company, reports that general trade conditions in all the territory are very good, and particularly on Fostoria Mazda lamps. The company will have its annual sales conference shortly after the first of January.

W. R. Thomas, president of the Columbian Electrical Company, St. Louis, Mo., states that, Kansas now being Democratic, the outlook is flattering. There are many requests for quotations on "White Way" lighting systems and for individual lighting plants for farm and country use. The company is conducting special campaigns on heating and cooking devices for the holiday trade, and on chandeliers, stand lamps, etc., working up an excellent demand. The company has been obliged to double its capital stock. A salesmen's meeting will be held in January.

Henry L. Walker Company, Detroit, Mich., has been appointed sales agent for Woods electrics by the Woods Motor Vehicle Company, Chicago, and has opened a new salesroom and garage at 4 and 6 Warren Avenue, West, corner Woodward Avenue, Detroit. The company will handle electric carriages and electric trucks. This is somewhat of an innovation for a supply house. The great interest manifested in electric vehicles of both the pleasure and commercial type insures the Walker company a very active field for the development of this business.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 107.—Thermal Cutout for Flatirons.—I understand that there have been patented several thermal cutouts for use with electric flatirons to open the circuit automatically when a certain temperature is reached and thus prevent burning out of the heating element. Has any iron on the market been equipped with a device of this kind that is both reliable and foolproof, so that it can be entrusted to the ordinary household servant?—W. L., Beloit, Wis.

No. 111.—Harmonizing Street, Window and Sign Lighting.—I have read many articles and papers pointing out the requirements to be met in securing the best possible lighting of a business street by means of ornamental tungsten-cluster posts; also other papers showing what is most desirable in store-window lighting; also a few articles on sign lighting. I have seen nothing, however, to indicate how these can be harmonized. Now it is contended by some people that these three kinds of lighting conflict more or less. Suppose a central-station company had the opportunity to recommend the arrangement of all these kinds of lighting in an ideal business block, what would be the most harmonious and effective way of doing so? In other words, toward what ideal should a solicitor work in producing an attractive and well balanced illumination?—J. S. M., Memphis, Tenn.

No. 112.—Dynamo Troubles.—Can a coil be cut out of a single series drum winding of a direct-current generator without seriously affecting its utility? Three burnt coils were cut out of an armature, which has 97 coils, and the segments were bridged, but in trying the armature out without load the bridging wires got excessively hot. Can the voltage due to residual magnetism in an 80-volt, 15-ampere generator be measured by using a 250-volt voltmeter? A small generator used for lighting a steam shovel refused to generate; the armature and both fields tested free from short and open circuits; in testing for residual magnetism with the shunt and series fields open and a 250-voltmeter connected to the brushes there were no signs of any voltage.—S. R., Hibbing, Minn.

No. 113.—Inverted Rotary Converter.—I have a bipolar, single-phase, one-fourth-kilowatt, rotary converter intended to change 220-volt direct current to 100-volt alternating current. Can I run this machine on alternating current to get direct current? Would it be self-starting from the alternating-current side if the field were left open? Would it be safe to connect the field when it had come up to speed? If it is not self-starting, could I make a three-phase machine out of it by putting on another slip ring and changing one of the other connections so as to make them each one-third the way around the commutator?—J. T. M., Chicago, Ill.

No. 114.—Guarding Against Excess Loads on Lighting Circuits.—What is the simplest way to guard against putting too many heating devices on an ordinary 660-watt lighting circuit at one time without blowing the fuse? I was called in to replace fuses for a lady that had a social gathering, during which she wanted to serve coffee to some guests and tea to others. She connected a percolator and samovar to the same circuit at the same time and was careful to turn off the lights, as she had been cautioned, before turning on the heating devices; as each of the latter took nearly 500 watts, the result, of course, was disastrous to the fuses and very embarrassing to the hostess. Is there not some electrical or mechanical way in which this could be guarded against, or must verbal caution alone suffice until experience teaches its lesson?—V. B., Milwaukee, Wis.

Answers.

No. 105.—Accuracy of Instrument Transformers.—Is the multiplying power of current and potential transformers used with alternating-current measuring instruments always independent of wave-form and frequency? Does it depend on the amount of load or the number of instruments connected to the secondary, or to the power-factor of the circuit?—W. I. R., Atlanta, Ga.

Wave-form, power-factor, and frequency have practically negligible effect on the multiplying power of both potential and current transformers. Variations of load do have a small influence on the ratio of current transformers which is ordinarily of no importance, but must be taken into account in work where very great accuracy is required. An article on this subject that explains this feature was published in your journal about a year ago. [See Electrical Review and Western Electrician of July 22 and 29, 1911.]—S. N. W., St. Charles, Ill.

No. 109.—Electric Radiators.—Why are electric radiators not so generally used in this country as in Germany and England?—B. T., Baltimore, Md.

When I was last in England, about 18 months ago, I did not observe such very general use of electric radiators as to create particular notice compared with their use here. In the English electrical papers I have recently seen, however, a large number of advertisements of radiators, both of the luminous and dead-resistance types, which leads me to agree with the inquirer that greater efforts are being made to introduce them to the general public than are evident in this country. That these efforts are likely to produce more fruitful results than may be anticipated here is quite evident for at least two reasons. The electric rates that prevail in most large British cities are much lower than are to be found here and not long ago I even read of a movement to give a special rate of one cent per kilowatt-hour to users of heating current. The English people have clung tenaciously to their old grate fires and have invested relatively little in stoves for heating rooms. An electric luminous radiator gives nearly as much cheer to a room as an open fire and overcomes all its objectionable features.—F. C., Troy, N. Y.

No. 110.—Commutator Trouble on Railway Converter.—At the substation where I am employed we have a 2,000-kilowatt General Electric rotary converter that gives a peculiar trouble on the 600-volt direct-current commutator. It is a six-phase machine with 672 commutator bars, 12 equalizer rings and 96 equalizer taps; the equalizer is on the negative side of the machine. Black spots sometimes appear on the commutator; these are the width of the commutator and extend over two bars, sometimes three. There are 8 positive and 8 negative brush brackets and there appear 8 of these spots about 82 bars apart. Recently after sand-papering the commutator the spots were gone for 17 days; then they reappeared, first the width of two brushes on inner end of commutator, and now they again extend the full width, but they are 27 bars ahead of where they formerly appeared. What causes this and how can I remedy it?—P. B., Chicago, Ill.

It would be impossible to attempt to give a definite answer to such a question unless I had a chance to make tests on the converter so as to ascertain the exact condition of the insulation on the different parts of the machine, as well as the voltages existing between the commutator segments, etc. However, judging from the information given, I believe that, due to some fault either in the insulation of the commutator from its shell or due to some fault in the insulation of the equalizer connections, one or more grounds exist on the armature of the machine and such grounds are so situated as to allow an extremely small current to flow through them so as to complete its path. Such a current may flow from the armature through the conductors to certain commutator bars, then due to defective insulation either in connection with the commutator bars, and the shell or frame of the machine or in connection with the equalizer connections, part of this current tends to take a short path to complete its circuit. Now, this current flowing from some of the commutator bars to this short path may cause small chemical action similar to electrolytic action, which, though extremely small, may in time cause the bars to become blackened.—H. E. W., Chicago, Ill.

LETTERS TO THE EDITOR.

At Least 1,380 More Years of Coal.

To the Editor:

We are pleased to breathe normally again now that the United States Geological Survey has enlightened us as to our coal supply.[1] Last year we were inclined to believe certain fallacious predictions, namely, that the coal mines of the United States would be totally exhausted within 100 or 150 years. 4,000 years, as estimated by several of our technical magazines on the basis of present exhaustion, should sound more soothing to those who really take rational conservation to heart.

The figures delivered by the United States Government are interesting—so interesting that one is tempted to dabble in figures for himself—and attempt to shorten the "coal period" as much as possible. Americans clamor for excitement. 4,000 years is so distant that we conservationists fear our "I-told-you-so" will have lost its effect.

Doubtless, the yearly consumption is gradually increasing. The increase of 1911 over 1910 was not given nor is the increase in a decade given. Assumptions must therefore be made.

Assuming, then, that the yearly increase is uniform, we can apply the formula:

$y\ (n+n^2)\ /\ 2$ for the total consumption of coal at the end of any year,

where y=yearly increase.

and n=number of years.

To the close of 1911, during a period of about 100 years, 14,181,980,000 short tons were mined.

Then $y=2\times14{,}181{,}980{,}000\ /\ (100+10{,}000)$ =2,810,000 tons.

Now, whether the rate of consumption increases with leaps and bounds or whether it decreases at a similar rate, and finally dies a natural death through scientific agencies, by blindly substituting this figure in our formula, equating it to the initial supply, namely, 3,076,204,000,000 short tons, solving for n and subtracting 100 years, we obtain a new figure that is a little more conducive to excitement, namely, 1,380 years.

W. F. SCHAPHORST.

New York, N. Y., December 18, 1912.

Three-Wire Service in Chicago.

To the Editor;

I wish to call your attention to your article in the issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of December 14, regarding the inspection rules of the Commowealth-Edison Company. These rules were printed in 1910, and since that time we have made several changes and additions. Such changes and additions as we make from time to time are given to the electrical contractors in the city through circular letters which are issued by our company. In your article you quote our rule which states that on lighting installations which exceed the equivalent of 24 fifty-watt lamps, a three-wire service must be provided.

Our contractor's circular letter No. 6 of May 18, raises this equivalent to 36 fifty-watt lamps for residence lighting, but does not alter the rule in business lighting. I thought perhaps that you would be interested to have your attention called to this matter. I believe, however, that some time ago you published a copy of this letter.[2]

ARTHUR P. GOOD.
Chief Inspector.

Chicago, Ill., December 20, 1912.

1 See Electrical Review and Western Electrician for November 30, page 1014.

2 See issue of November 9, 1912, page 886. —Editor.

Denver & Rio Grande Electrification.

Unofficial, but apparently authentic information, published in one of the Denver newspapers, said to have come from one closely connected with the negotiations for the electrification of the Denver & Rio Grande Railway, advises that the directors of the Rio Grande system have reached an agreement whereby the road will be electrified from Pueblo, Col., to Salt Lake City, instead of the two divisions between Minturn, Col., and Salida, and Helper, Utah, and Salt Lake City, as was originally announced.

The financing of the work, which will cost approximately $15,000,000, has been completed, says the report, and work will be rushed, so as to have everything in readiness to handle the travel to the San Francisco World's Fair in 1915. It is announced that the electrification of the road will be used as an asset to attract travel, and the company will play up the fact that tourists will be handled by electric locomotives, which do away with the annoyance of smoke and cinders.

It is also given out that the railroad company intends going into the land business, and with the co-operation of the Utah Power and Light Company, which was recently organized through the merger of fourteen electric plants in Idaho, Colorado and Utah, will endeavor to bring settlers into the territory contiguous to its lines. The object of the power company in such a deal, it is said, is to promote the sale of current through the advocation of the electric pump for reclamation and irrigation purposes.

There has been a good deal of comment on this project recently and further developments will be watched with interest.

Magnetic Hysteresis.

F. Holme has been investigating this subject in the case of the unsymmetrical magnetization cycle, and his results are reported in the *Zeitschrift des Vereins Deutcher Ingenieure*. He finds that for a given range of magnetization the hysteresis is very largely dependent on the absolute value of the induction at its upper limit, or, in other words, that the coefficient in Steinmetz's formula varies, depending upon the position of the magnetization cycle with respect to the zero line. His results did not prove sufficient to establish a formula for the variation. Generally, however, he found a very large increase in hysteresis, as the cycle was shifted upward, in the early and middle stages of the magnetization curve. At extremely high values, however, there appears to be a decrease; that is, of two cycles of equal range embracing the extreme upper part of the magnetization curve, the cycle of the highest position will have somewhat the smaller hysteresis loss.

Oklahoma City Chamber of Commerce Takes Up Ornamental Street Lighting.

The Oklahoma City (Okla.) Chamber of Commerce has in hand a plan providing an ornamental street-lighting system in the district bounded by the Santa Fe Railroad tracks, Hudson Avenue, Reno Avenue and Second Street, also extending north on Broadway from Second Street to Broadway Circle. The proposed plan calls for the erection of 591 posts, allowing from 10 to 14 posts to each square in the district. The plan has the approval of the city officials, who have agreed to bear 20 per cent of the cost of installation, maintenance and lighting, the other 80 per cent to be borne by the property owners, the whole to be handled by the city treasurer's office on a taxation basis. It is probable that the plan will be carried out.

Tanning by Electrolysis.

A Swedish scientist, L. A. Groth, has, after years of research, demonstrated that hides can be tanned upon a commercial scale by the use of electrolysis, and a demonstration plant has been erected at Kidderminster, England.

A great advantage claimed for this method is that a pure and strong tannage of heavy hides is effected in six weeks or less, as compared with many months by the ordinary process. The quality of the leather produced is extremely good. The cost of production is less than by the ordinary method. Current is used day and night with a load-factor of about 90 per cent, so that this application of electric energy forms a very desirable load.

Economics of Power-Transmission Lines.

An attempt will be made in this article to deal with the economics of the overhead power-transmission line from a broad practical standpoint, says Alfred Still, in *Western Engineering*. Some approximate figures for use in getting out preliminary estimates will be given, and in the working out of any numerical examples it will be assumed that the principles governing the selection of the most economical size of conductor require no explanation. When considering any scheme of power transmission from a generating plant of limited output, it is important to bear in mind that it does not pay to cover distance greater than that within which there are reasonable prospects of supplying all the power available at the generating station. The importance of this principle should be fairly obvious; yet there are instances which prove that it has been disregarded.

Choice of System.

On this continent it is usual to transmit electric power by means of three-phase alternating currents, the periodicity being 25 or 60 cycles per second. In Europe the Thury system of direct-current transmission at high voltages has met with success; it has much to recommend it, and there appear to be no reasons why it should not meet with equal success on this continent; but it is probable that three-phase transmission, at pressures even higher than those now in use, will hold its own for a considerable time to come.

Type of Transmission Line.

The structures for supporting the overhead conductors may be of wood, steel, or reinforced concrete. The wood supports may be of the ordinary single-pole type spaced 100 to 300 feet apart, or they may be **A** or **H** *frames* built up of two poles suitably braced, and capable of supporting longer spans. The steel poles may be of the simple tubular type, or built up of three or four vertical tubes or angles. The more common construction for high-pressure transmission lines consists of light-braced towers with wide rectangular bases, except where the "flexible" type of structure is adopted. These flexible towers are modeled generally on the **A** and **H** types of double wood-pole supports. It is by no means an easy matter to decide upon the most suitable type of supporting structure to be used on any particular transmission scheme. In some cases a composite line including two or more types of support may be found advantageous. Among the factors influencing the choice of the supporting structures may be mentioned the character of the country, the means and facilities of transport, climatic conditions, the nature of the soil, and the scarcity or otherwise of suitable timber in the district through which the line will pass. In undulating or hilly country advantage may frequently be taken of the heights, by erecting upon them comparatively low and cheap structures and spanning the depressions or valleys without any intermediate supports. The engineering features must, however, be very carefully studied in all such exceptional cases.

Length of Span.

Even when the type of structure has been decided upon, the height, strength and cost of the structures will be dependent upon the distance between them. The determination of the average length of span is indeed a very important economic question. The material of the conductor will, to some extent, influence the choice of span length, because aluminum conductors will usually have a greater summer sag than copper conductors, and this will necessitate higher supports to give the same clearance above ground at the lowest point of the span. In considering span lengths, the first cost of the individual support is not the only question which has to be taken into account; the cost of maintenance is almost equally important. The longer the span, the fewer will be the points of support; and if the line is well designed and constructed, there should be less trouble through faults at insulators. Again, where rent has to be paid for poles placed on private property, it is generally the rent per pole apart from the size of pole which has to be considered, and this is another factor in the determination of the best length of span. In level country, the economic span for steel-tower construction is usually in the neighborhood of 550 feet. If substantial, braced, wooden towers of considerable height are used in a district where such structures can readily be constructed, the economic span would probably be greater than 600 feet. It is hardly necessary to mention that, when comparing costs of various kinds of supports, the relative life and cost of upkeep of the poles or towers must be taken into account.

Effect of Span Variations on Cost of Steel Towers.

The height of towers in level country depends on (1) the minimum clearance between the lowest conductor and ground when the sag is greatest; (2) the voltage, since this has an effect on the spacing of the conductors and also to some extent on the clearance above ground level; and (3) the maximum sag. This last is determined by the lengths of span, the material and size of the conductors, the range of temperatures, and weather conditions generally. For the purpose of rough approximations suitable for preliminary estimates, I have made use of the empirical formula

$$H=35+0.3V+0.6\ (.01l)^2$$

This gives the approximate overall height of towers in feet. V is expressed in kilovolts and the lengh of span, l, in feet. The formula is especially applicable to towers carrying a duplicate three-phase circuit. The constants have been worked out on the supposition that there are six No. 0000 aluminum conductors and grounded guard wire joined to tops of the towers. It is not intended to apply to spans greater than 600 feet. In the case of larger spans advantage is usually taken of inequalities in the ground levels. The cost of steel towers will depend not only upon the height, but also upon the stresses which the tower has to withstand. These again will be dependent upon the size of the wires, the length of span, and the weather conditions. It is probable that, with an increase in height, the cost increases less rapidly than the square of the overall length, but for approximate calculations it is convenient to assume the relation: cost varies as H^2. Also, if the weight of a tower measuring 60 feet overall is taken at 1,800 pounds, and the price per pound of the finished (galvanized) tower at five cents[1], the cost per tower in dollars is $H^2/.40$.

The cost of the flexible type of tower is appreciably less, being about 0.7 of the cost of the rigid type with square base, or $H^2/.57$.

It is, however, usual to provide rigid strain towers in place of the flexible type at, say, every mile, and as the cost of such structures is about double the cost of the flexible tower, the cost of supports per mile of line may be calculated by assumng $(n + 1)$ flexible structures per mile, when the actual spacing is n to the mile.

Duplicate Lines.

A point of great importance in connection with power transmission is the means adopted to guard against interruption of supply. If it is allowed that the least reliable part of a transmission system is the line itself, it is certainly advisable, when circumstances permit, to duplicate the lines; the two sets of conductors being connected in parallel under normal con-

1 This cost may be anywhere between 3.5 and 6 cents per pound.

ditions. The best protection against interruption would be afforded by carrying the two sets of conductors on separate poles, preferably by different routes; but this would almost double the cost of the line, and it is usual to carry duplicate lines either on one set of poles, or on two sets of poles erected side by side on the same right of way. As an alternative to the duplication of the lines, the provision of reserve generating plant at the receiving end may be considered, and a comparison should be made between the relative advantages and costs of the various alternatives.

here reproduced, in the hope that they may be useful as a basis on which somewhat similar estimates may be shaped.

Preliminary Estimate No. 1.

Wood-pole transmission line, 20 miles long, carrying one three-phase line. Line pressure, 22,000 volts. Span, 130 feet. There is no grounded overhead guard wire; but two telephone wires are carried on the same set of poles. An allowance of 20 per cent is made for extra insulators and fixtures to permit of doubling these on corner poles and in other selected positions.

Estimate No. 1. Materials (Excluding Conductors).			
40 creosoted cedar poles, 35 feet long, 8 inches diameter at top	$400.00		
48 cross-arms, 3½ by 4½ inches by 4 feet long	14.50		
96 galvanized-iron braces, 1¼ by ¼ by 28 inches long	9.00		
32 galvanized bolts, ⅝ by 12½ inches, with washers; 8 galvanized bolts, ⅝ by 16 inches, with washers; 16 galvanized spacing rods, ⅝ by 16 inches, with nuts and washers	7.50		
48 galvanized lag screws, ½ by 3½ inches			
96 galvanized carriage bolts, ⅝ by 4½ inches			
1500 feet galvanized 7-strand 5/16 inch guy wire	12.00		
12 anchor rods with nuts and washers and necessary timber for anchor logs	7.00		
24 galvanized guy clamps with bolts	3.00		
8 galvanized sheet-iron bands to prevent cutting of poles by guy wire	0.50		
12 standard thimbles for guy wire	0.40		
20 galvanized-iron lightning conductors, with bolts	5.50		
20 ground plates or galvanized-iron pipes	8.00		
Staples and sundries, including allowance for breakages and contingencies	15.00		
80 telephone-wire insulators (glass); 80 side brackets for same (wood); 5-inch wire nails	10.00		
144 high-tension porcelain insulators	36.00		
96 galvanized-iron insulator pins with porcelain bases	14.40		
48 special pole-top insulator pins, with bolts	19.20		
Total material cost per mile of line		$562.00	
Labor.			
Clearing 50 feet on each side of pole line @ $30 per acre	363.00		
Distributing poles and other materials along the line	30.00		
Trimming poles, cutting gains, drilling holes, setting cross-arms	30.00		
Digging holes and erecting poles, including the necessary guying	80.00		
Fixing insulators and stringing wires, including telephone line	90.00		
Supervision and sundry small labor items	30.00		
Loss and depreciation of tools	10.00		
Management and preliminary work	25.00		
Total cost per mile for charges other than materials		$658.00	
Total cost per mile, excluding cost of conductor material			$1220.00
Conductors.			
16,000 feet No. 1 copper conductors (hard-drawn); 700 feet No. 4 copper for ties (soft); 10,800 feet No. 10 copper for telephone circuit; 4550 pounds @ 15 cents per pound			682.50
Total cost of finished line			$1902.50

A good example of steam-driven auxiliary plant in connection with hydroelectric power stations, is the recently completed oil-burning steam-generating station of the Southern California Edison Company, situated 25 miles from the city of Los Angeles, and capable of connecting in parallel with the 60,000-volt and 30,000-volt systems ordinarily supplied by the Kern River and other hydroelectric generating stations of this company.

Costs of Typical Transmission Lines.

It would be possible to give a large number of figures relating to material and labor costs of completed transmission lines; but the conditions of transport of materials and quality of labor differ widely, and without complete knowledge of these conditions, such figures are liable to be misleading. For this reason two ideal preliminary estimates, one referring to a wood-pole line, and the other to a steel line, are

Preliminary Estimate No. 2.

Flexible-type steel tower line, 60 miles long, with two sets of three-phase conductors. Line pressure = 80,000 volts. Average span, 480 feet. Spacing between wires 8.5 feet. A siemens-Martin steel cable, acting as grounded guard wire, joins the tops of all towers. Insulators of the suspension type. No telephone wires. Minimum clearance between lowest high-tension conductor and ground, 40 feet. Cost of right of way not included in estimate.

The cost of insulators increases rapidly with the rise of the working voltage. The curve of Fig. 1 gives approximate average price of insulators complete with pins or suspension links for pressures up to 100,000 volts. The prices are per insulator or per series of insulator units. The suspension type of insulator consisting of a number of units in series is almost universally used for pressures exceeding 60,000 volts. One golden rule which applies to all overhead transmissions is that it is false economy to reduce first cost by putting in cheap and possibly unreliable insulators. The curves of Fig. 2 are intended to supplement the figures of the typical estimates. They give approximate costs of transmission poles or towers, with and without insulators fixed in position. These costs are the averages of many actual figures, and give an approximate idea of the total expenditure per mile of line for various voltages; they do not include any clearing that may be necessary in wooded country, or payments for right of way. It is assumed that the conductors are of average size (No. 000 B and S gauge), but the actual cost of the conductors, whatever the size, must be added to the costs indicated by the dotted curves *B* and *D* in order to arrive at the total cost of the finished line. These dotted curves, however, do not include an amount to cover the labor of stringing the wires. The curves *A* and *B* refer to wood poles or rigid

Estimate No. 2. Materials (Excluding Conductors)			
10 flexible type, galvanized steel, A-frame towers @ $85	$850.00		
1 galvanized-steel strain tower	170.00		
concrete foundation where necessary	80.00		
5600 feet 7/16 inch galvanized Siemens-Martin steel-strand cable for guard wire and head guys on half-mile flexible towers	128.00		
4 anchor rods, complete with clamps and thimbles for guy wire	4.00		
90 sets of suspension-type insulators, including strain insulators and small allowance for breakages, complete with clamps	338.00		
Sundry small items or special material	50.00		
Total material cost per mile of line		$1620.00	
Labor.			
Clearing 60 feet on each side of line at average cost of $25 per acre	$363.00		
Distributing towers and other materials along the line	100.00		
Foundations for towers	75.00		
Assembly of parts and erection of towers	160.00		
Fixing insulators and stringing wires	170.00		
Supervision and sundry small labor items	50.00		
Allowance for loss and depreciation of tools	15.00		
Allowance for management and preliminary work	35.00		
Total charges other than materials per mile		$968.00	
Total cost per mile not including conductor material			$2588.00
Conductors.			
No. 00, hard-drawn, stranded-copper conductors; small amount of No. 2 soft copper for occasional ties; special clamps, shields, jointing materials, etc.; 13,350 pounds @ 15 cents per pound			2002.00
Total cost per mile of finished line, not including right of way			$4590.00

steel towers (for the higher voltages) carrying three conductors; while curves *C* and *D* refer to a single set of poles or towers carrying six conductors. The cost of a line with flexible steel structures for voltages above 44,000 might be about 75 per cent of the costs given by curves *A* and *C*. It is understood that the curves in Fig. 2 give only an approximate indication of the probable capital expenditure on the line. The actual cost will depend upon the character of the country, the nature of the ground, and other local conditions such as cost of labor and facilities for transportation. These, together with the weather conditions, force of wind and possible loading of wires with sleet or ice, will determine the most economical span and the average height of pole or tower. The cost, as previously mentioned, will also depend upon the material of the conductors, as a larger or smaller sag will influence spans and height of poles. The weight and diameter of conductors, by affecting the required strength of the supports, will be factors in determining the cost of the complete line, apart from any difference in the value of the conductors themselves. The actual cost of stringing very light or very heavy conductors will also differ from the average amount allowed for the purpose of plotting the curves. The number and style of lightning conductors, if any, and whether or not one or more grounded guard wires are strung above the conductors will obviously modify the average figures. Although steel or concrete poles, or steel towers, will generally be found more economical than a wood-pole line for voltages above 44,000 on account of the heavier insulators, wider spacing between conductors, and generally greater height of support, it does not follow that wood poles or wood-pole structures may not prove economical, even for comparatively high voltages, in countries where suitable timber is plentiful and the ready means of transportation and erection of steel towers are wanting.

Steel structures may be either galvanized or painted; the extra cost of galvanizing should be compared with the cost of painting periodically, say every third or fourth year. The cost of concrete poles will usually be between 50 and 80 cents per 100 pounds weight. A pole 35 feet high of square section 6 by 6 inches at top and 12 by 12 inches at bottom would weigh about 2,000 pounds.

The cost of foundations for towers varies greatly. In the case of fairly high steel towers with wide square bases in soil not requiring the use of concrete, the cost of excavating, setting legs, and back filling, not including erection of towers, will generally be between $10 and $20 per tower.

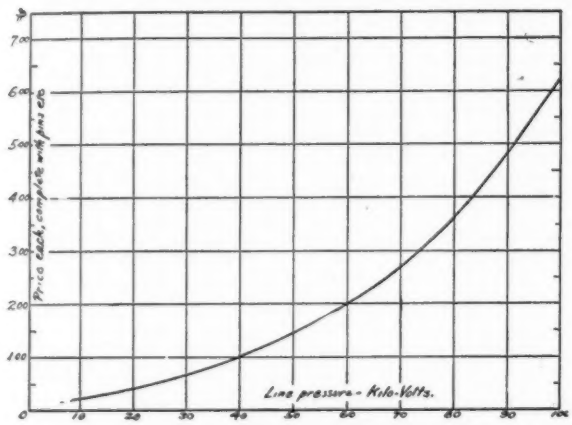


Fig. 1.—Cost of Insulators for Various Voltages.

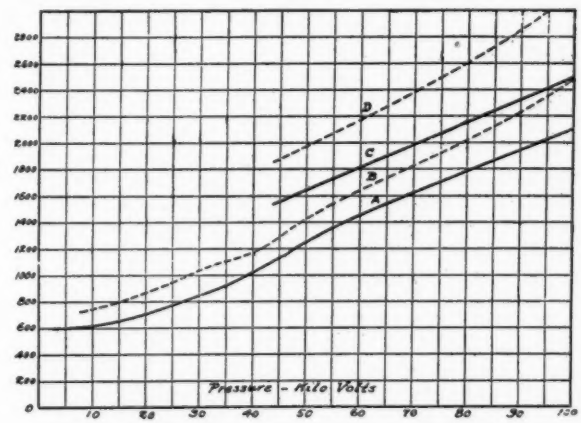


Fig. 2.—Cost of Transmission Line in Dollars per Mile. Curves B and D Include Insulators and Labor.

Cost of Conductors.

The capital expenditure on conductors will depend upon the material and the total weight. It is not proposed to discuss, in this article, the relative merits of copper and aluminum as conductor materials, but it may be well to point out that although, at the present market values of these metals, the use of aluminum may lead to some saving on first cost, there are many engineering points to be most carefully considered before definitely adopting either metal. The weight of the conductors necessary to transmit a certain amount of power over a definite distance will obviously depend upon the voltage, but apart from the engineering difficulties encountered at the higher voltages, there are economic considerations which determine the maximum voltage suitable for any given conditions. Among these may be mentioned a possible increase in the cost of generating plant for the higher pressures, the greater cost of step-up and step-down transformers and of the control apparatus, together with the line insulators, entering bushings, etc. The transmission-line poles or towers will also, as previously mentioned, cost more for the higher pressures, because of the wider spacing between conductors. Then again, with the extra high pressures, the increased losses through leakage over insulators and possible corona losses may be quite appreciable.

Given a definite amount of power to be transmitted, and a definite line pressure, the current can be calculated; and the economic conductor cross-section, and therefore the weight and cost of the conductors, will be directly proportional to this current. It is only of recent years that this fact appears to have been generally recognized, and yet, so long ago as 1885, in his Cantor lectures delivered in London, George Forbes said: "The most economical section of conductor is independent of volts and distance, and is proportional to the current." The determination of the current value to be used in the calculation of conductor sections is a real difficulty. It must not be supposed that even a knowledge of the load-factor is sufficient by itself. The load-factor being the ratio of average load to maximum load, does not give the relation between the average I^2R loss and the I^2R loss of maximum output. The power lost in the conductors of a constant-potential supply is proportional to the square of the power transmitted. On the basis of the average hydroelectric load curve, if the load-factor is 50 per cent, the load on which the average transmission-line losses should be based, being the square root of the mean of the square of the power, will probably be found to be more nearly 60 per cent than 50 per cent of the maximum load.

Economic Voltage.

Clearly the choice of the transmission

voltage is a very important matter; but as it is possible to determine the proper voltage on purely economic grounds, the use of exceptionally high pressures merely because of their interest from an engineering point of view, should be discouraged. On the other hand, it would appear that most transmission-line troubles occur on lines working at pressures between 30,000 and 80,000 volts; and an important consideration to bear in mind is that more trouble may be experienced with heavy currents than with high voltages, owing to the more serious effects of interruptions or transient disturbances when the current is large, so that greater security may sometimes be obtained by increasing the voltage with a view to reducing maintenance and operating costs.

A somewhat remarkable instance of high pressure being used for short-distance transmission occurs in Germany at Lauchhammer. This is the first 110,000-volt installation in Europe. The line is only 35 miles long, but the power to be transmitted is considerable, being 20,000 kilowatts. The engineers claim that, owing to large fluctuations expected through rolling-mill load, low voltages would be uneconomical. Under ordinary circumstances the trend of modern practice would indicate something above 60,000 volts as the best pressure in this case; but when there is little difference between the cost of a 60,000-volt and an 80,000-volt scheme, it is wise to adopt the higher pressure.

When figuring on the best voltage for any particular scheme, the capital cost of all works, buildings, or apparatus which is liable to be influenced by the transmission-line pressure, together with all operating and maintenance charges which may be similarly influenced, must be taken into account. It will usually be found convenient to reduce all such costs or differences of costs to the basis of annual charges.

Costs Other Than Transmission Line, Liable to Be Influenced by Voltage Variations.

The cost of a generating station complete with all plant and machinery, but not including transmission line, may be anything from $20 to $200 per horsepower installed. It will depend on total output, that is, on the size of the station, on location, and transport and labor facilities. The cost of a hydroelectric station will depend on the head of water, the amount of rock excavation, the size of dam, etc.

Approximate costs per kilowatt of medium-head hydroelectric power station and substation (not including transmission line) for total output of about 10,000 kilowatt appear below.

	Transmission-Line Voltage:		
	30,000	60,000	100,000
Hydraulic works outside power-station buildings	$15.00	$15.00	$15.00
Power-station building, including excavations	5.00	5.06	5.10
Receiving-station building	1.00	1.03	1.05
Switch gear (both ends)	1.20	1.35	1.70
Electrolytic lightning arresters	0.34	0.66	1.20
Transformers (both ends)	2.50	2.90	3.50
Generators and exciters	8.00	8.00	8.00
Cables in buildings, entering bushings, etc	0.40	0.40	0.50
Crane, sundries, and accessories, including preliminary work	2.00	2.10	2.20
Turbines and hydraulic equipment	10.00	10.00	10.00
Total cost per kilowatt	$45.44	$46.50	$48.25

The figures given in the table are approximate costs for a medium-head hydroelectric development suitable for a total output in the neighborhood of 10,000 kilowatts, to be transmitted over two outgoing three-phase feeders. The usefulness of these figures lies mainly in the indication they give of the probable differences in cost with the variation of transmission-line pressure.

Annual Charges Depending on Voltage.

These charges may be summarized as follows:

(1) A percentage on all capital expenditure, whether for generating station, transmission line, or receiving stations, which is not constant irrespective of voltage.

(2) The yearly cost of the power lost in the transmission line.

(3) The yearly cost of power lost in generators and transformers (the efficiency of the electrical plant will not necessarily be the same for all voltages).

(4) The yearly cost of maintenance and operation. This may depend upon length of spans in transmission line, and on the necessary plant, switchgear, etc., to be attended to, and kept in working order.

The percentages referred to under item (1) must include interest on capital invested, and depreciation.

Magnetic Properties of Iron Carbide.

At the meeting of the London Physical Society on November 8, a paper was presented by S. W. J. Smith on "The Thermomagnetic Study of Steel."

Thermomagnetic measurements make it increasingly evident that the magnetic properties of steel are frequently those of mixtures of magnetic substances, each possessing characteristic properties, which contribute in a comparatively definite way to the properties of the material as a whole.

In the case of a simple ferromagnetic substance, magnetizing fields can generally be found in which the permeability variation with temperature is comparatively small except in the neighborhood of the critical temperature. In such fields there is a very clearly marked peak in the permeability-temperature curve for the substance. The explanation of this peak which the molecular theory affords is well known, and suggests that the phenomena should be found common to all ferromagnetic substances. The immediate object of the paper is to show that it is exhibited by the carbide of iron (cementite) which exists in annealed carbon steels. For this purpose it is not necessary to isolate the carbide, because the phenomenon is quite clearly discernible in the permeability-temperature curves obtained for the steel.

The steel examined contained 0.85 per cent of carbon. It was found that the fields necessary to evoke the comparatively sudden variations in the permeability of the carbide above described are small, and such that the permeability variation of the iron present along with the carbide is slight in the neighborhood of the critical temperature of the latter. The sudden gain and loss of permeability by the carbide as the temperature alters will be roughly equivalent to sudden removal and replacement of gaps in the magnetic circuit through the steel. They should therefore be attended by correspondingly sudden rise and fall of the apparent permeability of the material as a whole. This is found experimentally to be the case.

There is a sharply marked peak near 210 degrees centigrade upon the permeability-temperature curve for the steel.

In the absence of measurements between 200 and 220 degrees centigrade the peak would escape notice, and it is for this reason, probably, that it has not been recorded before. It could scarcely be found by accident.

Record Maximum Load of Commonwealth Edison Company.

On December 11, 1912, the maximum load of the Commonwealth Edison Company reached the imposing figure of 232,950 kilowatts, which establishes a new record for this company. For the same day the station output aggregated 2,925,477 kilowatt-hours.

The increase in the connected load of the company for the fiscal year ending November 1, 1912, indicates an output of over 3,026,000 kilowatt-hours per day in the immediate future.

THE ECONOMY OF THE INDIVIDUAL ELECTRIC DRIVE[1].

By Frank Broadbent.

A few years ago, when the cost of electrical energy from a central station was many times the present rates, it was sometimes a little difficult to show any considerable saving by the adoption of electric driving in place of gas, oil, or steam-engine driving. There was always the handicap of fixed charges (interest and depreciation on the capital outlay of the electrical equipment) to take into consideration, because these items are very often omitted from the other side of the comparison. What it generally amounted to, therefore, was comparing the cost of coal, oil, or gas against the whole of the cost of electric driving, including the cost of electricity, interest, and depreciation on the outlay, wages, oil, sundry stores, etc.

Of course, neither a steam nor a gas-engine runs without labor, and there are little repairs to be done now and then, and the cost of oil and other incidentals is probably more than would be the case for electric motors; but it is one of the strange facts of the manufacturing business that it is only when electrical driving is adopted that an accurate system of cost keeping is kept in connection with the power plant. On the older systems interest and depreciation are not considered as factors in the power costs, because the manufacturer will tell you that the cost of the plant has been written off long ago; and as for oil, labor, etc., these he will tell you are negligible, as the cost is so trifling. It is a really remarkable tribute to the advantages of electric driving that it has succeeded in establishing itself under such handicapped methods of comparison.

As it was sometimes not possible under these conditions to show any marked economy over existing methods, considerable emphasis was laid on the incidental advantages of electric driving, such as the elimination of overhead shafting and belting, the steadier driving, the absence of dust, the easy control of speed, and the increased output obtainable.

In order to keep the fixed charges down to a minimum, a few motors of large size would be used in preference to a larger number of small motors. It was for many years an axiom that it did not pay to drive individually machines which required not more than about two-horsepower each, and that it was indeed very problematical if it were worth while to use smaller units than five-horsepower. This is one of the ideas which have persisted in spite of the changed conditions. For the conditions have changed very considerably during the past ten years or so, and the reduction in the cost of electricity and in the price of motors has very materially affected the whole argument.

Now, when electricity is so cheap that there is not much difficulty in showing a direct economy by the adoption of electric driving, the most economical methods are often not adopted; and electrical engineers are a little apt to lose sight of, or at any rate to attach less importance to, those incidental advantages of electric driving which formerly played so large a part in their arguments when the economical advantages were not so pronounced. In other words, they are inclined, perhaps, to take the path of least resistance, and put, down a power installation which, while showing an economy which satisfies the purchaser, does not give the full economy obtainable and all the other advantages which are possible.

The reduction in the cost of electricity acts directly, and the reduction in the price of motors indirectly, in the direction of improving the economical advantages of electric driving. The first acts directly by lowering the cost of energy, and the second acts indirectly by permitting of greater subdivision in the driving arrangements without unduly inflating the initial cost, and in this way tends towards further economy by reducing the consumption.

By way of illustration one might draw upon one's recent experience and show by one or two actual examples how individual driving even of the smallest machines is advantageous. First let us take the case of a group of six machines, each of which if individually driven would require three-horsepower. Taken collectively—that is to say, driven in one group, a 10-horsepower motor would be sufficient, owing to the intermittent nature of the work of each machine. The works owner proposed to drive the machines in two groups of three, using two 6-horsepower motors. This did not permit of any reduction in the amount of shafting or belting, but the use of two instead of one motor reduced the risk of stoppage in case of the breakdown of a motor. The overhead shaft was of considerable length, and together with the belting would absorb not less than two-horsepower. Reckoning the cost at two cents per horsepower per hour the cost of energy per annum to drive this shaft alone would be $96, reckoning 48 hours per week and 50 weeks per annum.

What we have to consider in a case of this kind is, whether it is worth while to spend $96 a year for warming up bearings, and wearing out belts rather than to drive each machine individually. From actual estimates obtained the difference in cost between two six-horsepower motors and their equipment, and six three-horsepower sets, was approximately $500. The cost of energy would be reduced by $50 to $75 per annum, so that on the least favorable estimate we can save $50 per annum by spending the additional $500. This in itself might be a sufficient inducement to incur the extra outlay, but in the case in question the incidental advantages of the individual drive were such that it would have been worth while to adopt this system even had the difference in consumption been less.

When driven by means of one shaft in the old-fashioned way, the machines were necessarily fixed in such a way as to back on to windows, necessitating aritficial light on the working side. Even had they been turned round, the operator would have been standing in his own light, and this arrangement would not have suited the manufacturing method, as it would have prevented the machines delivering their products direct into the gangway. By adopting individual driving it was possible to rearrange the machines, so that each man got a direct light on his work, and the general arrangement as it affected the manufacturing process was greatly improved. In addition to these advantages there is now an absence of the overhead shafting and belting. Each machine is quite independent of any other, so that the motors can be stopped individually as the machines are not required; and if at any time it is necessary to work late on one or two machines, this can be done without running any of the others.

To turn now to another case involving the driving of a dozen small machines, each requiring not more than 0.25 horsepower. It might seem, and a few years ago would have been, quite out of the question to drive such small machines as these individually. This was a case which formed a portion of the equipment of a new plant, so that if the machines were grouped new shafting, pulleys, etc., would be necessary. In small machines of this kind, which are worked by girls, overhead belting and shafting is very inadvisable, and if placed on the floor it may form an inconvenient obstruction. By individual driving this portion of the work is at once eliminated.

But first let us look at the question from the point of view of economy, and then see what additional advan-

1 From *Electrics*.

tages are offered by the individual drive. If the machines are grouped, the most convenient arrangement is to run them in two groups of six machines, using two motors of say two-horsepower each. The alternative method is to use twelve motors of 0.25 horsepower each, which can be each provided with a speed regulator. The actual difference in cost, based on definite estimates, is approximately, $500, exclusive of the cost of shafting which would be necessary for the grouped arrangement. If the grouping arrangement were used, we could not reckon on less than one-horsepower to drive the two shafts; and reckoning the cost of energy at two cents per horsepower per hour, it would cost, say, $48 per year to drive the shafting alone. Practically all this is saved by the expenditure of $500 on individual motors, and the cost of the shafting is saved. If we reckon 10 per cent on the outlay for interest and depreciation, the saving in running cost is offset by the capital charges, so that it is the incidental advantages which must decide the question.

By adopting the individual drive there is no need to group the machines in one place, and as they are used in connection with different departments of the work, it is more convenient to distribute them. This in itself is a considerable advantage from the point of view of works organization. Again, the ability to run each machine independently, and to control its speed, permits of the machines being run at their best speed for the work in hand, or at the maximum speed at which the girl operator can work. This speed varies considerably with the dexterity of the girl and length of experience she has had. In both the cases instanced above, the works owners needed little or no persuasion at all to adopt individual drive when it was found that the cost of running, added to the standing charges on the increased capital outlay, would not be more than that involved for group driving.

The foregoing are typical cases, showing how each drive should be considered. It is not the best engineering to drive a lot of shafting and belting or other unproductive machinery by motors if a higher degree of economy can be obtained by greater subdivision; and in any scheme of electrification it should be possible to show that each motor employed is justifying its employment, either on the score of economy or in some way.

According to official statistics, the production of tungsten in Bolivia during the year 1911 amounted to 297,272,120 kilograms, valued at $115,500,000.

BOOK REVIEWS.

"A Laboratory Manual of Alternating Currents." By John H. Morecroft. New York: Longmans, Green & Company. Cloth, 247 pages (5½x8¾ inches), 175 illustrations. Supplied by the Electrical Review Publishing Company for $2.80.

This laboratory manual is by one of the professors at Columbia University and belongs to the more advanced type of text-book. In looking over this book one is impressed by the change that has taken place in the character of laboratory handbooks within recent years. Not many years ago, many, if not most of the electrical engineering schools used no text-book in the laboratory work. The apparatus usually consisted of a nondescript collection of new and discarded machinery that the head of the department had been able to collect. The laboratory work was based on the regular lecture text-book supplemented by such notes as the instructor was able to prepare. Under these conditions the work differed greatly in different laboratories. As soon as some of the simpler experiments became somewhat standardized, laboratory manuals began to appear. These to a great extent reflected the environment under which they were written. The manuals that have been recently published are not only much more advanced in so far as the subject matter is concerned, but they are also more cosmopolitan. Usually the local color is given by describing the apparatus, giving diagrams of connections to be used, and arranging a log for the readings to be taken. Professor Morecroft's book omits most of this, but gives a careful, and in some cases quite full, analysis of the principles involved in the experiment; explanations of the phenomena to be investigated are made; the different variables that enter into the problem and possible errors are discussed. In this manner, 39 different experiments are outlined. These experiments include such subjects as: influence of wave forms on alternating-current meters; power-factor; inductance; capacity; resonance; various tests of alternators, both as generator and motor; transformers; polyphase circuits; rotary converter; induction motor; induction generator; series motor; mercury-arc rectifier etc. In many cases, to the instructor and student is left the working out of the scheme of connections, meters to be used and log.

That the use of such a manual imposes more work on the instructor as well as student is appreciated by the author, for as he points out, "a laboratory course should be primarily designed to teach the student methods of analysis, and to emphasize the theory presented in lecture courses, rather than to facilitate the perfunctory performance of a set of experiments." To the reviewer it seems that this very fact will preclude the extended use of this manual as a laboratory text. Most instructors are overburdened under present conditions, and it is, perhaps, too much to expect that they can find the necessary time to give the help and supervision demanded by such a book.

It is true that the student should be taught methods of analysis, but the question naturally arises, how is the student's power of analysis to be developed? Is this power best developed by a text-book that gives a complete analysis of the physical phenomena, but leaves to the student the working out of the mechanical details so as to verify this analysis; or is it preferable to show the student how to arrange his apparatus, what readings to take and then compel him by skillful quizzing to analyze his data and thus practically delevop the theory? The writer should like to see tried the latter method, and believes that a greater and more accurate power of analysis would be developed by such a process.

To follow out Professor Morecroft's plan, the student as well as instructor will have to do much preliminary work, and if time will permit this preliminary preparation will prove to be very beneficial. The student will not only have to determine the best method of conducting the experiment but will have to devote considerable time to the study of the theoretical exposition given by the author. While this theoretical treatment, although advanced, is in most instances comprehensive and clear, especially so under experiment 13; in other cases, as in experiment 27, a fuller treatment would be helpful, and also it would add to clearness if the theoretical matter were separated more distinctly from the few directions for conducting the experiment.

For a first edition the book is quite free from errors of statement as well as typographical errors, but the latter are found on page 63 where the reference should be to Fig. 28 instead of Fig. 29; on page 79 the reference (Fig. 28) should be Fig. 37; and Fig. 39 is not a transformer, as one would be led to suppose from the statement on top of page 101.

The denominator of equation (1) page 106 has a superfluous radical sign, and the reference to Experiment 18, page 113, should be to Experiment 19. Another slight error is found on page 126, where it is stated that I_1, the total current output of transformer A, is measured by ammeter A.

The value of the work is enhanced by quite a number of reproductions of ondograph and oscillograph records in the appendix. Laboratory instructors will find the book very useful as a work of reference to which they can go for suggestions, and for the elucidation of many difficult problems. Its value in this regard would be greatly

increased by the addition of a good index.

C. M. JANSKY.

"Hygiene for the Worker." By William H. Tolman and Adelaide Wood Guthrie. New York: American Book Company. Cloth, 225 pages (5x7 inches), illustrated. Supplied by the Electrical Review Publishing Company for 50 cents.

It is a notorious fact that medical practitioners enjoy no better health than the average person. While it is to be assumed that through their knowledge of physiology, anatomy and medicine they should know how to so order their lives as to keep in perfect health, it is a patent fact that they do not as a rule observe the laws of hygiene. The authors of this book have realized the fact that a knowledge of hygiene is not so necessary as the formation of good habits, and the book has been written from this point of view. The reader is told how rather than why, although inducements to the proper care of the body are advanced in the form of the financial benefits which it will bring through favor with employers, etc. The book is one of a series designed primarily for school children, the present volume being intended for boys and girls from 13 to 18 years of age, and is suited for use in classes in vocational, industrial and manual training schools. The scope of the book is thus hardly what one would expect from the title, since such subjects as occupational dangers and diseases occupy but two chapters out of the 19. Questions of cleanliness; suitable food, drink and clothing; fresh air; ventilation; and exercise receive considerable attention, and simple directions for cultivating good habits along these lines are given. Tuberculosis and first aid to the injured have each a chapter devoted to them. The proper safeguarding of dangerous machinery and some of the legal provisions for the protection of workers are given consideration. A summary of rules at the end of each chapter helps to impress the main points upon the mind of the reader.

"Mechanical Equipment of Federal Buildings Under the Control of the Treasury Department" (Second revised edition). By Nelson S. Thompson. Baltimore: Williams & Wilkins Company. Cloth, 272 pages (6x9 inches). Supplied by the Electrical Review Publishing Company for $2.00.

This volume takes up in order the various engineering details of large buildings and should prove very helpful to the architect or engineer who is concerned with this work. It will be especially valuable for contractors or builders who are bidding on government work or executing a contract for the same. Electrical matters are considered only as they occur incidentally with respect to lighting fixtures, the motor operation of elevators, etc., and the installation of small power plants. The forms of specifications usually followed in the Office of the Supervising Architect are given. The author is the chief mechanical and electrical engineer in the Office of the Supervising Architect, who has control of the general equipment of all federal buildings in this country. The headings of the various chapters are as follows: heating and ventilation; plumbing; drainage and water supply; gas piping; conduit and wiring systems; lighting; elevators; small power plants; motors and controlling apparatus; vacuum cleaning systems; operating data.

"Reception des Signaux Radiotelegraphiques transmis par la Tour Eiffel." By Bureau des Longitudes. Paris: Gauthier-Villars. Paper, 55 pages (5¾x9 inches), illustrated. Supplied by the Electrical Review Publishing Company for 35 cents.

This pamphlet consists of three chapters devoted respectively to the installation of receiving apparatus, an explanation of the time signals which are sent out, and the work of making precise comparisons of astronomical clocks or chronometers at distant stations. Instructions are given for the installation of antenna and earth connections and the various forms of detectors are explained, as well as the adjustment of the apparatus for receiving. The third chapter, which constitutes a half of the entire book, will be of interest mainly to astronomers and geodosists.

"Mechanical World Pocket Diary and Year Book for 1913." Manchester, England: Emmott & Company, Limited. Cloth, 388 pages (4x6 inches), illustrated. Price, Sixpence.

This is a volume of pocket size containing a number of tables and much information which will be of value to the mechanical engineer and shop man. The steam engine, steam turbine, steam boiler, oil engine, gas engine and gas producer receive attention. The section devoted to spiral gearing deserves special mention, as this is a subject not usually included in handbooks. Tables are given for the cutting of gears of this form as well as of the more ordinary form. There are a number of mathematical tables and tables for conversion of units in different systems.

"The Theory of Ionization of Gases by Collision." By John T. Townsend. New York: D. Van Nostrand Company. Cloth, 88 pages (4½x7½ inches), 12 illustrations. Supplied by the Electrical Review Publishing Company for $1.25.

Recent extensions of our knowledge of electrical discharge in gases makes the subject of ionization one of much present interest. In this volume the author considers the experimental data upon which are based the theories of ionization and explains the mechanism as well as the mathematical relations involved in ionization by collision of molecules. The presentation is interesting but involves considerable mathematics, and the volume will be of interest chiefly to the scientific reader.

"Tables Annuelles Internationales de Constantes et Données Numériques de Chimie, de Physique et de Technologie." Volume I for 1910. By the International Committee of the Seventh Congress of Applied Chemistry. Paris: Gauthiers-Villars, and Chicago: University of Chicago Press. Cloth, 726 pages (8½x10⅓ inches). Supplied by the Electrical Review Publishing Company for $5.00 unbound or $6.00 bound.

This volume represents an enormous work in the compilation of physical, chemical and technological constants as published in the year 1910. This work has been started by the International Congress of Applied Chemistry, which appointed a committee for the purpose, and the work is to be continued each year. Its great value consists in placing at the disposal of the reader all the work in these lines which has been published in the recognized journals of the world and will, consequently, save much individual search. The value of such a volume can hardly be estimated and it is surprising to see how productive the investigators of the world have been. The collaborators and editors have not attempted to express any opinion upon the value or accuracy of the data given, but have taken them as given by the author, and when criticism of this kind is desired it will be necessary to look up the original publication, reference to which is given in each case. The experience gained during the first year's work will no doubt aid the committee in defining the limits to be observed in future years. The work of compilation is to be carried on permanently and the volume for 1911 is nearing completion and will soon be issued. As the work has proved greater than was anticipated, the price of Vol. II will be increased. For subscriptions received before January 31, 1913, the price will be $6.00 unbound; after that date the price will be higher.

Important Joint Meeting in Chicago.

On the evening of December 23 an immense audience thronged Association Hall, Chicago, to enjoy an illustrated talk by W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, on the new Northwest Station of that company. The meeting was held under the joint auspices of three engineering societies. A more complete report will be given in the next issue.

New Electrical and Mechanical Appliances

Alexalite Indirect Lighting Fixtures.

Indirect lighting has become deservedly popular in the last few years for many places where comfortable vision is of prime importance and where it is desired to have the illumination very diffuse and uniform and so arranged that no direct rays from any lamp can strike the eye. The possibilities of ornamental treatment have been developed by the manufacturers of indirect-lighting equipment, and among these the Alexalite Company, of New York City, has brought out many attractive designs, a few of which are illustrated herewith.

In all Alexalite fixtures the interior of the reflector basin is coated with a durable, fired, porcelain enamel which does not change in cold nor deteriorate with time. The reflecting surface is very easily cleaned. Its character and shape is such as to throw the light broadly over the ceiling without causing any streaks from filament images. Each fixture uses only a single Mazda tungsten lamp suspended in its natural pendent position. The exterior of the bowl can be finished to harmonize with any desired style of interior decoration. The bowl can be suspended either from the stem or from canopy direct.

Gothic Type.

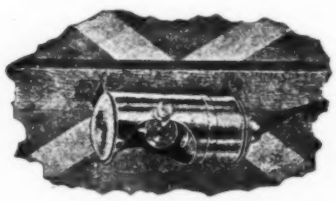
A large number of interesting installations of Alexalite fixtures have been made in office buildings, stores, theaters, etc. Among these is one in Siegel, Cooper & Co.'s large department store in New York City. The old arc lamps in this building were replaced by 2,800 Alexalites. It is stated that during the first six months of their service the use of these fixtures produced a saving of about $2,700 over the operating and maintenance cost of the arc-lamp equipment for a similar period, besides giving a steadier, more uniform, pleasing illumination.

The Central Electric Company, Chicago, Ill., is the exclusive central and western selling agent for Alexalites.

Plain Type.

Canopy-Top Lamp for Automobiles.

An electric lamp specially made for lighting the tonneau of any automobile using a canopy top has been placed on the market by the Cleveland Electric Storage Battery Company, 116 Market street, St. Louis, Mo. The lamp is fastened to the bow supporting the canopy top just over the rear seat. Its use gives some of that taste and refinement to a gasoline car that usually can be had only in an electric vehicle. The lamp is a standard six-volt lamp and is mounted in a brass or nickel cylinder 3.5 inches long and 2.5 inches in diameter. This case has a shutter which can be closed to protect the bulb against breakage when the top is let down.



Canopy-Top Lamp.

Chicago & Alton to Install Telephones for Train Dispatching.

One of the latest railroad systems to be convinced of the value of using the telephone for the dispatching of trains is the Chicago & Alton, which has recently placed an order with the Western Electric Company for the equipment necessary to install its first circuit. The selective system of operation will be employed and will be similar to that now in use on the lines of the majority of the large railroad systems of the United States and Canada.

The equipment to be installed will consist of the No. 102-C relay-type selector sets which contain the Standard No. 50 Western Electric selectors. The way stations will also be provided with standard telephone-set equipment and a complete wire chief's testing equipment will be furnished for the dispatcher's office.

The circuit to be equipped extends from St. Louis, Mo., to Bloomington, Ill., a distance of approximately 160 miles, with the dispatcher located at Bloomington. The number of way stations to be provided with selector apparatus is 36.

Engraved Type.

Electric Tempering Furnaces.

Reference is made in a pamphlet recently issued by the United States Bureau of Mines to the necessity of adopting the latest methods in the hardening and tempering of steel, if waste is to be avoided. An instance is recorded in which a manufacturer, at present making about 300,000 steel blades a day, has reduced his costs

more than one-half through the adoption of up-to-date methods. About three tons of cold-rolled steel per week are now used. The blades were formerly hardened by using 65 machines which utilized gas and blast for the heating process, ran day and night, and required 15 men for their control. On the advice of an engineer six electrically heated furnaces have been installed which, in an eight-hour day, give double the old capacity and require the services of only two operators. For the tempering process, the blades, 70 pounds at a time, are dipped into an electrically-heated salt bath, and are held for a definite period at a temperature precisely controlled by pyrometers.

New Railway Watt-Hour Meter.

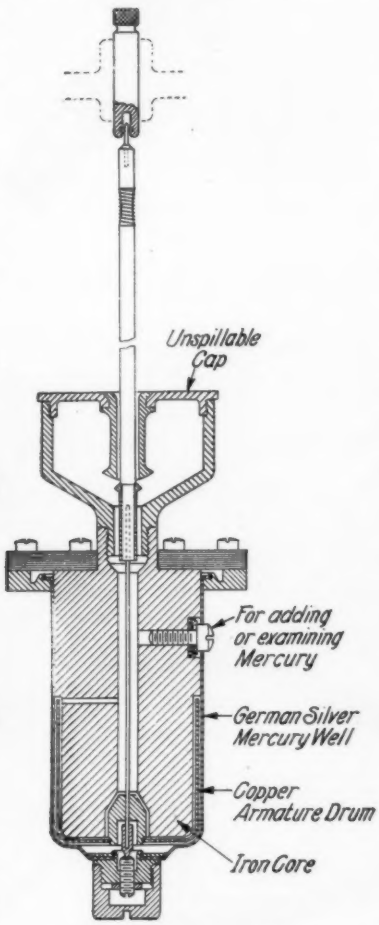
The railway watt-hour meter installed on electric cars makes possible scientific management in the operation of the cars. The performance of the car equipments can be checked and

Railway Watt-Hour Meter.

any trouble that reduces the efficiency discovered and removed. Moreover, it is often desirable to make a comparison between different cars which may run over the route at different times and the watt-hour meter measuring the energy consumed affords data for such comparison even though the voltage varies to such an extent as to make results obtained by other means worthless. The meter records also tend to show the motormen the method of operating the cars with minimum power consumption. In fact, where reliable car meters are used, it immediately becomes interesting to see who can hold the record for the operation of the cars with minimum power consumption. Experience in metering other kinds of service demonstrates that a saving should be effected by the use of car watt-hour meters sufficient to make a substantial showing in increased earnings.

The meter shown in the illustrations herewith is contained in a cast aluminum-alloy case and all parts, with the exception of the shunt, which is in a compartment in the back of the base, are mounted on a substantial cast aluminum frame supported on four pillars and completely insulated from the base and cover.

The rotating element or armature is a cupped copper punching attached to a shaft which is carried in a ring-stone and end-stone bearing at the bottom



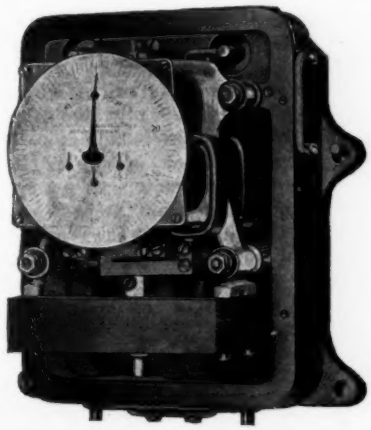
Section Through Meter.

and a ring-stone bearing at the top, the end-stone bearing being secured to the bottom of the German silver vessel which serves as a container for the rotating armature and the mercury in which it is immersed. The immersion of the armature in mercury does away with a commutator, frictional contacts and sparking troubles. By partially supporting the moving element in the mercury, wear on the bearings is very slight.

The laminated core of the potential coils is in contact with opposite sides of the mercury well, and, with the inner iron core, forms a complete iron magnet circuit, with the exception of the two gaps in which the armature rotates.

Leads from the terminals of the meter shunt project down into the mercury, but since the mercury has a much greater resistance than copper, and the inside of the mercury well is enameled, the current flows from the lead through the mercury direct to the copper armature, along the latter to the other side and out through the mercury to the other lead. As the copper armature is free to move, and forms a conductor which carries current in a magnetic field, it is repelled from the field, producing rotation at a speed proportional to the reaction. The rotation is therefore proportional to the energy in the circuit and can be calibrated to measure true watts.

The register has a large round dial with a sweep hand, which makes one revolution for every 100 kilowatt-hours, each division on the dial corresponding to a kilowatt-hour. There are also three small dials with hands which make one revolution for 1,000,



Interior of Meter.

10,000 and 100,000 kilowatt-hours, respectively.

The top of the German silver vessel is provided with a cap to prevent the mercury running out when the meter is tipped to one side. A disk attached to the meter shaft and rotating between the poles of two sets of permanent magnets serves as a means of calibration.

The watt-hour meter is of rugged construction, all parts being designed very liberally so as to have an ample factor of safety to withstand the excessive vibration incidental to this service. In order to carry out this feature of high factor of safety, high insulation has been provided, together with long creeping distances between live parts and the case, and a high potential test of 5,000 volts alternating current is applied for one minute.

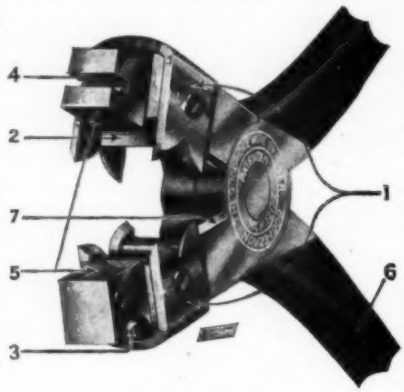
The current-carrying parts of the meter have been so designed that they

will carry twice their normal current for ten minutes, three times normal current for three minutes, and five or ten times the normal current for a few seconds. The case is made dustproof by accurately machining the surface which rests on the base and by the use of a heavy felt dust pad as further safeguard. The watt-hour meter described above is manufactured by the General Electric Company, Schenectady, N. Y.

Goodridge Wire-Skinning Pliers.

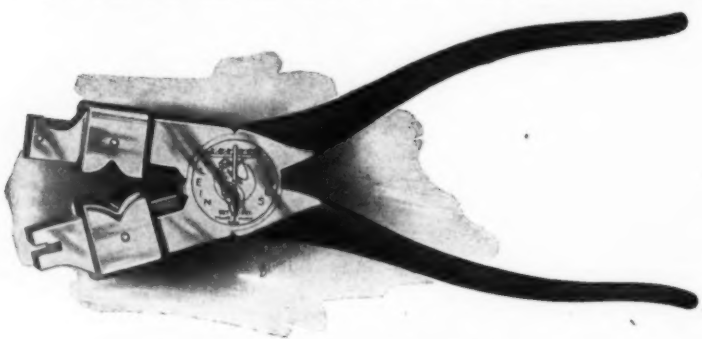
Every wireman knows that a large amount of time is consumed in making joints by the necessity of removing the insulation of the wire. The usual jack-knife method of peeling the insulation is not only tedious but, unless done by a skilled and careful workman, frequently results in nicked wire, unequal joints, much needless waste of tape and occasionally cut fingers. When joints have to be made in wire that is already run in place and particularly in outlet boxes or other fittings, this labor is not only more wearisome but usually results in still greater waste of time and material.

This troublesome feature of wiring work has been practically eliminated by the Goodridge wire-skinning tool and pliers illustrated herewith. Its use is extremely simple and permits removal of the insulation in about one-tenth of the time. The jaws merely have to be applied and squeezed, producing a neat and clean-cut edge to the insulator without any harm to the wire itself. The construction of the tool is such that the four lateral knives cut the insulation square across and another knife at the same time splits the insulation longitudinally so that it can be readily pulled off by the roughened square jaws. This is shown by one of the illustrations herewith in which *1* indicates two of the knives for cutting the insulation, *2* the splitting knife, *3* a knife for scraping the wire, *4* slots for bending loops in the wire ends, *5* jaws for pulling off the insulation, *6* the tool handles which are of the same length as for standard eight-inch side-cutting pliers, and *7* a pair of side-cutting jaws. The entire tool is 7.75 inches in total length and is now made only for use with No. 14 wire, since this size of wire constitutes about 90 per cent of the wire used for interior work.



Details of Pliers.

The Goodridge wire-skinning pliers are manufactured and sold by Mathias Klein & Sons, 562 West Van Buren Street, Chicago.


Goodridge Wire-Skinning Pliers.

Acid-Proofing the Floors of Battery Rooms.

A great deal of attention is being given to the proper method of acid-proofing the floors of battery rooms. It is recognized that nothing can be done to make concrete floors themselves acid-proof. They have been treated with linseed oil thinned down with gasoline, but this method has retarded the action of the acid only temporarily. Acid-proofing preparations have been tried out by one of the leading concrete construction companies of New England but have not proven a uniform success.

The general construction of the floor of a battery room consists of vitrified brick or tile placed on a concrete base. Frominent authorities state that the best way to acid-proof such a floor is to place several layers of acid-resisting felt cemented together with an acid-resisting compound between the brick and the concrete. The correct way to do this is first to give the concrete floor a coating of hot compound, then lay in this several thicknesses of felt, lapped so that the joints of one layer break joints with the under layer. Where this procedure is followed it is necessary to use sand for imbedding the brick. To protect the walls and any columns in the battery room, it is advisable to turn up the felt for a foot or so at the walls or columns, putting three courses of brick against the felt and pouring the compound behind the brick so as to make a tight joint.

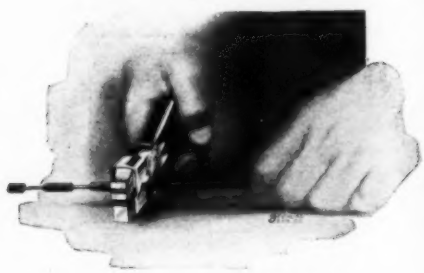
The New York Edison Company, which is noted for using large factors of safety in all of its construction, takes extra precautions in acid-proofing floors. It usually specifies two distinct courses of several layers of acid-resisting felt, cemented together with acid-resisting compound.

In one of the recent specifications of this company for the floors of a transformer and battery station, it is stated that the contractor should spread over the rough concrete floor a layer of 1.5-inches cement mortar finished with a smooth surface. As far as acid-proofing is concerned the specifications were as follows:

"Over the cement mortar surface shall be laid three layers of Hydrex felt, bonded with Hydrex compound. The cement surface shall first be coated with a continuous and uniform layer of compound, to which it must adhere at every point. Where the felt is turned up on the walls and drain boxes, an additional layer of felt and compound running parallel with the intersection of the two-plane surfaces shall be applied.

"Over the completed acid-proof course shall be applied a layer of compound.

"Immediately after the acid-proofing is cool, or soon enough after to insure against damage, the contractor shall spread a layer of cement mortar about 1.5 inches thick over the entire horizontal area of the acid-proof course. This will form, after setting, a working surface on which the rest of the work shall be built."


Showing Use of Pliers.

After the protecting layer of cement mortar has set the specifications call for a course of concrete with a cement mortar finish and on top of this a second layer of acid-proofing consisting of two layers of the acid-resisting felt with three courses of the hot compound. Upon the top of this last acid-proofing course were laid bricks, the joints of which were filled with the hot compound as specified above.

It is interesting to note that the tests of the New York Edison Company have shown that the felt and compound used in this connection are not at all affected by sulphuric-acid solutions. The Hydrex felt is an elastic preparation impervious to water and is said to be also a protector against electrolysis.

The Brach Grounding Device.

Good grounding is the ability to get the best available results from the soil. It means the securing of the lowest possible resistance contact between the conductor or ground wire and the earth itself, and it is only accomplished by a proper choice of location and method of grounding. When possible, grounds are placed in moist earth or located in soil high in mineral, having a natural advantage toward high conductivity.

Three things are essential to make low-resistance contact with earth. First, moist earth must be obtained or created. Second, a substantial area of metal surface of the grounding device should be exposed to the earth. Third, firm contact should be made between the earth and grounding device.

To aid in securing these necessary conditions a device termed the Brach Hydro-Ground has been developed, and it will be found that several features have been incorporated in its design that will take care of conditions known to be essential to satisfactory grounding.

To secure the first essential, moist earth, the Hydro-Ground has three bowls or cups fastened to a center ground rod. This provides a means for rain water as it seeps through the earth to be caught and retained within the grounding device itself. This water will remain in those bowls as long as the surrounding earth is moist. When, by reason of the hot sun, evaporation takes place and the earth becomes dry, there still remains, for a long period, a local moist area, due to the water that will be given off by the bowls. To further aid in attracting and holding the water, small pieces of charcoal within the bowls are furnished with the ground, and this is covered by a perforated metal screen. The perforated screen itself is intended to protect the space in the bowls from bing displaced by the surrounding earth, so that ample water space may be retained.

The second feature, namely area of contact exposed, is accomplished in the Brach device by the fact that these three bowls act as a layer of copper and have their upper and lower surfaces exposed toward the earth, so that for a hole of given size a large area is in contact with the earth. In the case of a copper plate, the digging of a hole equal to its area would be necessary, or in the case of a cylindrical arrangement half the area would be faced toward the inside of the device itself.

The third essential, securing firm contact with the earth, is also taken care of in the design, as the gauge of copper used and the shape of the bowls are so chosen and reinforced that the earth may be packed firmly around without bending or affecting them in any way.

Brach Grounding Device.

The general construction of the Brach Hydro-Ground consists of having the center rod sweated firmly to the three bowls and the rod itself provided with a patented connector, this affording easy means of joining a ground wire and securing a reliable connection. This connector consists of a slot tapering outward and running parallel to the length of the rod at the threaded portion and so arranged that when the nut is loosened a wire may be inserted along the side of the rod and tightened down by the nut, wedging the wire into the slot. If desired, the slot may be also used to aid in soldering the connections.

They are now furnished in three standard sizes, each size having three bowls of varying diameters. The L. S. Brach Supply Company, 143 Liberty street, New York City, manufactures the Brach Hydro-Ground.

The Western Electric's Contributions to Progress in 1912.

As in former years, the Western Electric Company has during 1912 furnished its share of new developments in the interests of world progress. The following recounts some of the most striking developments in telephone and power apparatus.

Telephone Apparatus.

Railway Train Dispatching. — The Western Electric selectively operated semaphore has been highly developed. Semaphore blade and spectacle segment are of the standard type. The pole body differs from the usual type in that it contains a casting wherein is located the selector and talking apparatus as well as the mechanism for tripping and restoring the semaphore blade. The semaphore is operated selectively from the dispatcher's office, an answer-back signal notifying the dispatcher of the operation of the apparatus.

Two types of selector apparatus cases have been developed for use in dispatchers' offices. The No. 51-A for dispatching circuits only and the No. 52-A for dispatching circuits and signaling stations on intercalling selective circuits each contains a telegraph relay for controlling current supply, protectors of the fuse and open space cut-out type, condensers, resistances and retardation coils for choking out noises on the circuits.

Intercommunicating.—A new type of desk set for private line and for outlying station use in master and outlying station Inter-phone systems is a self-contained instrument having a push button in the stem for signaling other stations and a buzzer in the base. A mechanical signaling system has been devised for use in connection with Inter-phone systems. It provides for the simultaneous ringing of a number of bells and further is arranged to repeat the signal a number of times. The code signaling sets used in this system make use of keys similar to those employed in telephone train dispatching work. They can be provided to give 4, 6, 8 and 10 different signals.

Switchboards and Switchboard Apparatus. — Switchboard development work during the past year has been confined to improving, in every possible way, the more recent types placed on the market. This applies to the sectional unit type, the No. 1800 magneto, and the No. 1801 central-battery, lamp-signal boards for small magneto offices and private exchanges.

The new convertible switchboards have also met with great success. There are three standard types:—the No. 1246 non-multiple using combined jacks and signals, the No. 1013 using combined

jacks and signals and the No. 1014 using lamp signals. These are so designed that they may be used for either magneto or central-battery service, or both, without changing any of the apparatus. This enables the small telephone company to change from magneto to central battery gradually and at a minimum of expense. It thus becomes unnecessary to buy a complete new central-battery exchange before the "cut-over" and go through the confusion incidental to such a change.

One of the most important developments of the year in switchboard apparatus is the No. 194 "line and cut-off" relay for subscriber line use. It is considerably smaller than the old standards used in the past. Although smaller and more compact it operates with the same efficiency and is notable for the accessibility of the contact springs, its positive action and the fact that there are no knife-edge or gravity-operated contacts. This relay marks a great step forward in switchboard apparatus.

For use on magneto line switchboards, there has been developed a combined jack and drop which is similar to the combined jack and signal but differing from it principally in that a shutter-type drop is used in place of the familiar spherical indicator. The shutter is restored when a plug is inserted in the jack.

Loud-Speaking Telephones—A new "loud-speaking" telephone has been developed and was tried out with success at the Boston Electric Show (October 1912) for paging visitors and show officials, for announcing scores of the World's Series Baseball Games and for rendering musical selections in conjunction with a phonographic attachment.

Automobile Telephones—For permitting easy communication in limousine-bodied automobiles, between passenger and chauffeur, a telephone set consisting of a spoon-shaped transmitter and a horn-shaped receiver of the loud-speaking type has been developed.

Portable Magneto Sets—A portable forest service set for the use of rangers in the United States Forestry Service has been developed and a large number furnished to the Government. The set consists of talking and signaling apparatus contained in a leather case and a bayonet type ground rod with a considerable length of flexible cable. Portable magneto sets of the same general type as the forest service sets have been developed for general use.

Telephone Arms—Two new types of telephone arms have been placed upon the market. One is a balanced, self-contained arm having a desk stand body with a transmitter and receiver at the upper end. It is so arranged that in whatever position the arm may be in the desk stand portion is always vertical. The other is of the folding or "ferry" gate type with a similar desk stand body. This arm is also self-contained.

Miscellaneous.

A battery gauge for testing dry batteries used in connection with high-resistance transmitters has been developed. Single cells or three cells in series can be tested, the gauge showing the "cut-off" point. It may also be used for testing interrupter and coin collector batteries.

A compact metal-type telephone set has been developed for use on central-battery systems.

The design of the No. 20 type desk stand has been improved by replacing the cast lug holder by one produced from seamless tubing. It is a one-piece affair made by a specially devised set of pneumatic forming tools.

Power Apparatus.

The new developments in power apparatus have been concentrated in great part on the new Western Electric-Sturtevant vacuum cleaners. These are made in three portable and three stationary types of different sizes. They are electrically operated—the motors being of Western Electric and the fan or suction part of Sturtevant manufacture. The cleaners are of the large-volume, high-velocity type using a centrifugal fan.

Cutler-Hammer Manufacturing Company Developments in 1912.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., announces a very material development in a number of its standard lines. Taken altogether the year 1912 showed a healthy increase in business, with the outlook more than bright for a continuation of improvement.

Push-Button Switches and Specialties.

The year 1912 was the best year in the history of the push-button switch and specialty department of the company. The output increased a greater per cent and more newly developed devices were put on the market.

Because of the increased use of electric lighting on automobiles the sale of Cutler-Hammer push and pull battery switch for automobile use exceeded all other switches. These switches are sold through jobbers principally to automobile manufacturers, the majority of whom are now equipping their cars with electric lighting systems.

The brass shell pendant switch No. 7007 known as the "Acorn" switch was received favorably because of its graceful design, easy push-button operation and small size. The porcelain pendants have moved along with the others and are in high favor especially for damp and dusty locations. To the composition feed-through or cord switches have been added a brass-shell polished-nickel single-pole and a three-heat type cord switch which are used to provide convenient control of heating devices and other small portable electric devices.

Three attachment plugs have been put on the market, one all-porcelain, one all composition and one having porcelain base with black composition cap. Three types of attachment plug-receptacles with the same contact construction were also marketed. The caps of these and the attachment plugs are interchangeable. A new composition cord connector also has the same cap and contact construction as the receptacle.

The base of the moulding-type surface switch is now made in one piece instead of two and a new circular-base push-button surface switch has been added to the line for use with concealed wiring. The porcelain socket is made somewhat smaller and the shell consists of two parts instead of three as formerly. Single-pole, double-pole and three-point flush switches are entirely new developments of 1912.

Battery-Charging Rheostats.

The types of battery-charging rheostats now designed and built at the Milwaukee works have a number of distinct features, such as compactness, convenience and wide range of application. The new design increases the efficiency of the garage operator by offering every facility for the correct charging or discharging of the battery. For instance, in case of a vehicle not giving its rated average mileage and where some doubt exists as to whether the mechanical or the electrical equipment is at fault, the discharge rheostat can be used to determine whether the batteries are capable of giving their rated ampere-hour capacity.

The arrangement of the panels is such that the instrument switch is placed directly to the right of the row of contacts so that each rheostat and its particular instrument switch are together. The design allows the operator to get a reading of the battery voltage and charging current for the particular rheostat being used by a single movement of the instrument switch and the charging circuit is not broken so that arcing (which is particularly severe on large equipments where the ampere reached sometimes from 150 to 200) does not occur and the switch blades are not burned or roughened.

With the new panels, wherever space permits, all rheostats are so arranged as to be accessible from the floor so

that a cane with a hook or ring at one end is not needed for operating the rheostat lever.

Electric-Vehicle Controllers.

Cutler-Hammer electric-vehicle controllers are now mostly of the foot-control type, although some have been arranged to be operated by means of a small lever projecting through the steer-wheel shaft. Master drum-type controllers have also been developed for use on battery cars, a noteworthy installation being on the Federal Battery Car Company's car used for suburban traction service.

Fire-Pump Starters.

Fire-pump starters for both direct and alternating-current motors have been made for the requirements of the National Board of Fire Underwriters, Factory Mutuals Association, Chicago and New York Municipal Boards. More starters having combination manual and automatic operation were made than those having just manual or automatic control. Pump controllers besides those made for fire protective service are however principally of the automatic or remote-controlled types.

Elevator Controllers.

In the elevator field the tendency is more than ever toward the electrically-operated type. The increased amount of building has resulted in a corresponding increased need of elevator and elevator controller, the output of Cutler-Hammer controllers being about 20 per cent greater than for 1911. Because of central-station recommendations alternating-current motors are used to a considerable extent and new developments and features have been added to the alternating-current elevator controllers.

Many push-button automatic elevator controllers have been furnished small hotels, office buildings, apartments, etc.

Theater Dimmers.

Installations of theater dimmers in New York, Pittsburgh, Chicago, Boston, Washington, Seattle, San Francisco, England, etc., kept the dimmer department busy. A new dimmer plate was also developed which has a winding on both sides instead of on one only. This also has a great many more steps providing finer gradations in the brilliancy of the lamps. The greater number of steps are also needed where tungsten lamps are used. The new construction reduces the amount of space required and makes the plate suitable for three-wire and also for two-wire dimmers up to certain capacities. The requirements in the dimmer field have tended toward greater refinements and convenience of operation.

Motor Starters, Regulators and Controllers.

Many new types of automatic starting devices and magnetic switches have been developed during the past year. These are made in small and large capacities and for both alternating-current and direct-current motors. As the electric motor becomes more universally applied each year there is an increasing need for motor starters and other regulating and controlling devices. The output of automatic or self-starters has been greater during 1912 than for any previous period. Special type automatic starters and controllers for severe mine service have been developed for use in connection with mine fans and pumps. In the alternating-current line many new styles of starters, regulators and automatic controllers have been added to meet the requirements of increased alternating-current motor installations. A five-inch regulator for small motor-driven and heating devices has been added to the six-inch regulator line.

Presidential election year did not affect the demand for automatic contactor-type steel-mill, and coal and ore-dock controllers, the steel mill shop being busy with orders throughout the year and being cramped for room at times. In this line automatic features, sureness of operation and simpleness and strength of construction are in demand to a greater extent than ever before.

The drum-type, inclosed crane controllers which were brought out the latter part of 1911 have been augmented by the addition of types for alternating-current service.

Portable Meter-Testing Rheostats.

The meter-testing load rheostats used by central stations in connection with meter testing on the consumer's premises have been made lighter by the substitution of a new insulating base on which the resistance is wound. Increased air spaces also made possible by the new insulating base increase the capacity of the rheostat.

Printing-Press Controllers.

A printing equipment department has been established with offices in the *Times* Building, New York, to take care of not only the Kohler system and Cutler-Hammer printing-press controllers but other equipment required in the printing plant. This office is in addition to the general office in the Hudson Terminal Building, 50 Church Street. For small presses a new line of self-starting speed regulators has been developed, while for the larger push-button control equipments new refinements have been added. The use of automatic controllers for printing presses has increased not only for newspaper work but for the magazine and job printers also. Alternating-current controllers are being used to a considerable extent, new styles being added and the Carpenter direct-current controller line, augmented by the addition of a polyphase alternating-current controller.

Lifting Magnets.

The record of not a single ground or short-circuit in a standard Cutler-Hammer lifting magnet is still intact but the period is now for over three years instead of two. Another magnet has been sold for "under-water" service to the Vancouver Salvage & Dredging Company, Vancouver, B. C. A 24-inch magnet provided with special pole shoes has been put on the market which will handle an 8,000-pound skull-cracker ball, over 10 times the weight of the magnet. An 18-inch magnet has also been made and the demand for special types of rectangular magnets has shown a marked increased as magnetic lifting has been applied to various new uses in industrial establishments.

Magnetic Separators.

Many new uses have been found for the magnetic separator which was first built to any extent during the year of 1911. In the cement mills they have been used for taking out the mule materials from the run-of-mine coal before it is passed to the pulverizer mills, the first installation of this kind for the year being made at the plant of the Southwestern Portland Cement Company, El Paso, Texas. In the paper pulp mills they are being used for taking nails, etc., from the wood chips. Many special applications have also been made.

Sangamo Electric Company Has Big Year.

The Sangamo Electric Company has experienced a growth rather out of the ordinary during 1912. The combination of new conditions, broader lines of manufacture and an extended sales organization has resulted in an increase of 90 per cent over that of 1911 and every indication is that 1913 will show an equally good record. It is very improbable that the prevailing prices on meters will be increased and the central-station industry will continue to receive the benefits brought about by new competition introduced by the recent patent expirations.

By January 1, 1913, the company's new large additions to the factory will be completed and in full operation. Early in the Spring work will be started on a second addition which advance business now booked will fully warrant. In addition to the regular line of meters, the company will also announce during 1913 several entirely

new lines of detail apparatus demanded by the natural growth of the business.

Westinghouse Developments in 1912.

The Westinghouse Electric & Manufacturing Company, East Fittsburgh, Pa., announces many technical developments in its lines during 1912.

Railway Development.

There have been a number of developments in the railway field that have contributed greatly to the high state of perfection which electric railway engineering has reached. These developments indicate that more attention has been paid to the economic side of railway operation, such as improvements in car and locomotive equipments; generating and converting apparatus.

The equipment recently furnished the Piedmont Traction Company, of North and South Carolina, is of particular interest because the voltage, 1,500, is the highest direct-current pressure used in this country for electric traction, and its use marks an important epoch in the advance of direct-current traction. The current is not generated by the company, but is supplied by the Southern Power Company through sub-stations, being obtained from two synchronous, motor-driven, 750-volt direct-current generators connected in series.

The switching equipment follows the same lines as for the 600-volt equipment with the addition of precautionary measures, such as heavier insulation, longer breaking distances, and removal of live parts from the operation. The breakers are mounted higher than the lower voltage type, and are generally operated by a rod similar to oil switches.

Electric locomotives continue to gain favor, and a number of roads already using them have increased their equipment, and several other roads have bought their initial equipments during the year. Among these roads, purchasing Baldwin-Westinghouse locomotives, are the Piedmont Traction Company, the Southern Pacific Company, the Oakland, Antioch & Eastern Railroad Company; all of which are equipped with high voltage direct current motors.

The Southern Pacific Company has ordered 12 locomotives for use on the coast for freight haulage and switcher service, but these may be used for passenger service if desired.

The New York, New Haven & Hartford Railroad Company has purchased an additional equipment of 39 locomotives; three of which are for either alternating-current or direct-current operation, and the remainder are for straight single-phase operation.

Probably the most noticeable advance in railway motor design is the "light-weight" motor for the Pittsburgh Railways Company, which was built by the Westinghouse company for use on a car with 24-inch wheels. This design is the outcome of the tendency towards light-weight city cars, and the adoption of the 24-inch wheels by the Fittsburgh Railways Company.

An increasing number of roads have adopted the use of the unit switch control, not only on multiple trains but also on single cars.

One of the most important recent developments is the use of Westinghouse field control. This is effected by having a greater number of field turns on the motors, and by arranging the control so that a portion of the winding is cut out of the circuit. When a portion of the field winding is cut out, the characteristics of the motor are modified just as if the gear ratio had been instantaneously changed.

Portable sub-stations are being more extensively used this year; a number of roads having adopted them. The uses to which they may be put are: Used as spare equipment; to assist in locating the most advantageous space for a permanent station; to assist at times of unusually heavy load.

Commutating poles as applied to rotary converters fulfill the same functions and result in the same advantages as when applied to generators and motors. This last year has seen a number of this type of rotary built; some of very large capacity, including one of 7,500 kilowatts, with a momentary capacity of 10,000 kilowatts. A particular feature of this rotary is that it occupies but slightly more space than that of the 1,500-kilowatt converter which it replaced.

Switchboards.

Perhaps one of the most striking developments during the past year has been the great economies in space effected by the use of seven-inch meters, permitting the manufacture of switchboards which have 25 per cent less length than similar boards manufactured heretofore. This has been accomplished without any sacrifice in readability of meters. Further development has been the application of black dials with white markings and white pointers to switchboard meters for use in locations which are poorly illuminated and which depend largely upon artificial illumination. Desk control boards are being ordered in larger proportion than heretofore, as the advantages of this neat and compact method of control are beginning to be appreciated.

Transformers.

The developments in Westinghouse transformers during the year 1912 have been chiefly from a standpoint of increasing the scope of outdoor distributing transformers and improvement in ruggedness and serviceability. The past year has shown a rapid increase in the use of higher distributing voltages, and, especially in the Western portion of the country; large numbers of outdoor-type transformers have been installed for such voltages as 6,600 and 11,000 volts, and yet of very small relative capacities, such as one to five kilovolt-amperes. These installations have permitted the addition of a large amount of ranching, farming and irrigation load that was previously not available.

Oil Circuit-Breakers.

The development during the previous year tended largely towards increase in capacities, and this has been carried still further during the past year, so that now practically all of the larger types of oil circuit-breakers are of the modified design, and involve the following features: brush contacts with butt type arcing tips; tanks are lap welded and are larger, giving greater oil capacity and more air space above the oil. Above the tanks in some of the larger types is a cast bronze gas expansion chamber, with a baffled vent for the escape of gases. The tanks are supported, in addition to the ordinary clamps, by steel rods from the cast base to a steel plate under the tanks, thus preventing any possibility of the tanks being blown off by an extra violent short circuit. The mechanism of the breakers has been improved so as to provide quick action, with dash pots to take care of both opening and closing shocks. With these improvements the instantaneous direct connected breaking capacity has been greatly increased in the different types.

A new breaker of the same characteristics as one of the well known masonry types (E) has been brought out for mounting on the wall or pipe framework. It requires no cell structure, and because of this omission has a larger breaking capacity than the corresponding size for masonry-mounted breakers.

The type GA (44,000-110,000-volt) breaker, having a separate tank for each pole, previously limited to 300 amperes capacity, has been increased to 600 amperes; and a modification of this type has been developed for use on from 11,000 to 44,000 volt circuits, and possessing a lower breaking capacity. They have porcelain bushings instead of the condenser terminals, and are supplied for outdoor mounting.

A newly developed line of circuit-breakers, known as the "Reactance"

type, has been supplied in some forms, and designs are available for application of the reactance principle to other breakers. With the double break and a reactance inserted in the second or final break, the ultimate breaking capacity to which the Westinghouse company can work is said to be unlimited.

Carbon Circuit-Breakers.

A new type of small and moderate capacity carbon circuit-breaker has just been developed by the Westinghouse company, which is a modification of a type used some years ago. It is made mainly from punchings; is quite rugged in design; held in the closed position by the ordinary trigger arrangement. It is made for alternating current or direct current; one, two or three-pole, up to 300 amperes and 600 volts.

The large capacity (2,000 to 14,000 amperes) carbon circuit-breaker, placed on the market by the Westinghouse Company about two years ago, has been entirely re-designed during the past year to cover capacities of from 1,000 to 20,000 amperes. In the re-designing, the carbon arcing contacts have been copper coated, providing a constant low-resistance connection between the carbons and shunts. The secondary contact has been changed in design so as to provide a stationary contact at such an angle to the moving contact that there is not the same tendency to buckle the moving contact in closing the breaker after the contact surfaces become roughened by arcing.

The alternating-current forms of this breaker have been perfected with spacing between brushes so as to provide for better ventilation, and laminated studs have been provided so as to prevent heating on alternating current. All breakers have been given an exact alternating-current rating, and are now listed with the various ratings applicable to direct current, and the different frequencies of alternating current.

Generators—Turbo, Waterwheel and Engine Types.

During the past year a number of contracts for hydroelectric stations have been placed, which call for 12,000 to 17,500 kilovolt-amperes, and even larger generators are in prospect.

In steam practice a similar progress is being made. The Westinghouse companies have designed and are building horizontal units of 15,000 and 20,000 kilowatts for speeds of 1,800 and 1,500 revolutions per minute, and even larger high-speed units are contemplated. Single turbine-generators of 30,000 kilowatt capacity for a speed of 1,500 or 1,200 revolutions per minute for 25 and 60-cycle service, is a possibility of the near future. These units are also being wound for voltages as nigh as 13,200.

Industrial Motors.

Considerable development has taken place in the application of alternating-current slip-ring, phase-wound induction motors for the operation of large electric shovels. Two 60-ton shovels so equipped are now in operation in the Northwest, and one equipped with 25-cycle motors is now under construction for use in an ore mine in Sweden.

In connection with machine-tool application, the most prominent advances have been made in the reversing planer motor and controller.

Another interesting development is the application of electric motors to logging donkeys.

The commutating-pole, direct-current motors of the Westinghouse company are the first motors having rolled-steel frames to be applied to elevators.

The development of self-starting synchronous motor for direct-connection to air compressors, while not really a new development in 1912, has now been perfected and is practicable for all commercial purposes. A greater number of these outfits were installed in 1912 than in all previous years.

During the past year several coal dock equipments have been installed, and though steam-operated rigs were estimated on originally, the majority of the plants will be motor operated throughout. Power will be furnished by central stations.

Motor drive is superseding hydraulic drive in many steel-mill applications on account of absence of freezing and other troubles. A practice which is rapidly becoming quite general is the use of motors for lifting the doors of the open-hearth furnaces. The mechanical features are simple, and a practical design is to make a separate and complete unit, including motor, control, gearing, etc., for each door.

There has been a large number of new steel mills built during the last several months and in almost every case electric drive has been considered for the main rolls. In many cases, it has been adopted in preference to steam-engine drive.

In the mining field there have been many applications of electrical energy, including power for heavy hoists, air-compressors and mine locomotives.

Small Motors.

No radical departure of the general features of design of alternating-current or direct-current small motors has been made but marked progress has been made in the details of design and process of manufacture tending to lighter weight, more compact construction and reliable operation. Improvements have been made in the starting torque and centrifugal clutch of the single-phase motor, enabling it to take care of starting conditions in a large majority of conditions to be met with. The range of application of the small motor is wide but the demand in the past year has centered in the home nd office, more particularly on washing, dictating, tabulating, mailing and similar machines and vacuum cleaners.

The Electric Vehicle.

Certain distinct features mark the advance and increase in popularity of the "electric." Better operating characteristics due to improvements in motor, controller, battery, transmission. The motor is more efficient and rugged, quieter, and lighter in weight. Chain drive has been largely replaced by some form of gear drive in which the motor is either mounted directly on the rear axle or on the chassis and connected thereto by a jointed shaft.

The electric truck is increasing at a remarkable rate. Companies including various industries which had tried them out in individual cases are now using them in large fleets. Excellent and accurate data on operation and maintenance being secured and disseminated, is doing much to advance the cause of the electric truck.

Arc Lamps.

Developments during the past year have been confined almost exclusively to flame-carbon arc lamps of the long-burning type. Ten to forty-hour lamps have been used very extensively abroad for some time and their general adoption in this country has been only delayed by the comparatively high maintenance cost due to the necessity of frequent trimming and high price of carbons. The long-life lamp, however, has overcome these obstacles and is now being used in large numbers not only for street but also for display lighting, and especially for industrial plants, wharfs, docks and large public buildings. The fact that carbons giving either white or yellow light may be used renders the adaptability of the lamp more flexible.

Rectifiers.

The vibrating-type rectifier has just been placed on the market. This will very satisfactorily take care of the charging of batteries used for vehicle lighting and gas-engine ignition purposes. It is neatly designed, compact and light, and may readily be carried on the vehicle and is of particular benefit to the motor car owner who has a three-cell battery equipment, as it enables him to charge the batteries at his convenience with small expense, directly from an alternating-current

lighting circuit. This rectifier was described in last week's issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.

Watthour Meters.

The lower priced, low-capacity house-type watthour meter has been extended to capacities up to 25 amperes, and a standardized form of bottom-connected meter has been produced and regularly listed. The gear train has been changed so as to include double reduction in the sub-gear train between main disk shaft and the worm, instead of using single reduction with one large gear wheel. The sub-gear train bearings have been lubricated.

A new type direct-current watthour meter has been produced which differs from the previous standard Westinghouse direct-current meter in having the armature in the center; the gear train at the top, and the damping disk at the bottom of the shaft.

Portable Meters.

A new induction-type ammeter has been placed on the market, which supersedes the older type, having a damping disk running between permanent magnets. The meter is by this means highly damped, and by means of other changes the total weight of the moving element is not increased. The winding has been changed, giving as a result a highly damped, extremely high-torque meter, with minimum weight of moving element.

A D'Arsonval type meter has also been brought out to supersede an older type. It has single air-gap construction with permanent magnets rigidly mounted before they are magnetized and aged. The magnets need not be disturbed in removing moving element for inspection. Special attention has been paid to ease of inspection and repairs.

Another typ of meter has been developed that operates on the dynamometer principle, and will be supplied as voltmeters, wattmeters and powerfactor meters. This line of meters will present new features in the following points: higher torque, and lower weight of moving element than previously obtainable. Special attention has been given to the mounting of parts for greater permanence of calibration and ease of inspection and repairs.

Indicating Meters.

The induction-type switchboard meters have had the weight of the moving elements decreased by the use of aluminum shafts with steel pivots. Nameplates with white background and black letters have been adopted as standard; thus showing entire length of pointer against a white background. Meters having black dials with white pointers and white figures have been developed and applied on several switchboards.

The automobile-type meter has been developed and placed on the market. This is a meter three inches in diameter, made on the double air-gap D'Arsonval principle. It is supplied in three forms: ordinary round type for use on either automobile dashboards or on small switchboard panels; flush type mounting for automobile dashboards, and illuminated dial type for automobile dashboards.

A new low-priced graphic meter has been developed. It has a moving iron element similar to the Bristol round chart meter. It is supplied as a voltmeter, and as a two or three-wire ammeter, and for either alternating-current or direct-current service. This meter represents a direct advance over the round chart meter in that it has a continuous paper scale long enough for seven days' record at one inch per hour. It has a seven-day clock, and a new type of pen which will carry ink enough for seven days.

Lightning Arresters.

The electrolytic lightning arrester in the higher voltages has been changed so as to include smaller diameter tanks. The same degree of insulation is obtained by lining the tanks with a substance which is impervious to water; thus providing constant and adequate insulation at all times.

For the highest voltages, this type is now supplied upon special order with elliptical instead of round tanks These tanks allow of mounting two stacks of trays side by side, and this design is used where there is not sufficient head room to allow for the standard round tanks with all trays in one vertical stack.

Heating Apparatus.

A number of electrically heated devices have been developed during the year.

The saute pan is a universal cooking utensil which may be used for frying, boiling, baking. It is eight inches in diameter and six inches high.

The type C domestic iron is provided with a device whereby the current may be controlled at the iron without disconnecting the cord, though the cord is easily disconnected when desired. The heating element of this type is improved to the point where it can be guaranteed for life.

The type D laundry iron is of the same design as the type C domestic iron, but is not provided with a cutout at the cord, which enters through the handle.

The cozy glow radiator is a small radiator of unusually attractive design, consisting of two units, which is sold at a popular price.

The new pot-type coffee percolator is valveless and has but three parts: top, body and combined coffee vessel and stem.

The soldering iron is designed to do as much work as a regular soldering iron several times larger. It is provided with a copper tip which is easily removable. The iron is well balanced and easily handled. Wattage consumption is 125.

The tire vulcanizer outfit consists of a vulcanizer, flexible cord and attachment plug, 16-step rheostat attached to the clamp, two canvas attachment straps and a thermometer. It is used in vulcanizing cuts and tears in the inner tube, and sand pockets, blisters and tears in the outer casing, the average process requiring from 15 to 30 minutes.

The frying pan does, of course, everything that the frying pan which is heated on the stove will do, and in addition it may be turned up-side-down on its aluminum stand and made to serve the purpose of a disc stove.

Micarta.

"Micarta" is the trade name for a new material brought out by the company in 1912. It is primarily an insulating material, but is readily adaptable for many other applications, such as valve seats, bushings, etc. It is composed of layers of special temperature-resisting paper bonded together and thoroughly impregnated or saturated with a special bonding material. It is a tan-colored, hard, homogeneous material having a mechanical strength about 50 per cent greater than hard fiber. It can readily be sawed, milled turned, tapped, threaded, etc. It is not brittle and will not warp, expand or shrink with age or exposure to weather.

Delta-Star Electric Company.

H. W. Young, president of the Delta-Star Electric Company, Chicago, states that the development in high-tension protective apparatus during the past year has been along the lines of weather-proof equipment for use in connection of high-tension outdoor sub-stations. Business conditions have been very satisfactory as compared to 1911 and can be attributed to the natural increasing demand for high tension equipment.

Early in 1913 a new line of automatic and non-automatic air-break, high-tension switches will be announced, their special application being in the protection of out-door substations. The established line of S. & C. high-tension chemical fuses is being extended as new conditions arise, and particular attention is being paid to the weather-proof forms up to and including 66,000 volts.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

TAYLOR, N. D.—This place is projecting an electric light system. C.

BRECKENRIDGE, MINN. — A "White Way" for this city is now an assured fact. C.

VENICE, CAL.—Plans are being prepared for an ornamental street lighting system.

BATAVIA, IOWA.—The Booster Club is considering installing an electric light plant. C.

EAU CLAIRE, WIS.—There is agitation for a "White Way" for Barstow Street and Grand Avenue. C.

TROPICO, CAL.—Bids will be received up to January 23 for a 40-year electric franchise in this city.

MURRAY, IOWA.—Gilbert Johnson has been granted a franchise to erect an electric light plant in this town.

PRESTON, IOWA.—The proposed $8,000 bond issue for an electric light system has been decided favorably. C.

DUNCOMBE, IOWA.—The Duncombe Electric Light & Power Company has been granted a franchise in this place. C.

DUNDEE, ILL.—The Village Board of West Dundee has decided to install an electric lighting plant to light the village streets. Z.

CHATTANOOGA, TENN.—North Chattanooga, a suburb of this city, desires an electric light plant to furnish illumination for its streets. G.

EXCELSIOR, MINN.—The Excelsior Electric Company will extend transmission lines to Wayzata and Ferndale to furnish lighting. C.

DYERSVILLE, IOWA.—The Dyersville Light & Water Company contemplates installing a new plant, if a renewal of franchise is granted. C.

BUTTERFIELD, MINN. — Steps may be taken to secure electric light and power from the plant of the Rapidan Power Company at Rapidan. C.

BATAVIA, ILL.—Plans by the City Council for improving the municipal electric light plant next summer include the purchase of a $7,000 engine.

WAHPETON, N. D.—There is a demand for a "White Way" on Dakota Avenue, and it is being proposed that property owners pay for the posts.

NORTHFIELD, MINN.—Ornamental street lights are projected for next year. The matter will probably come before the Council at the January meeting. C.

HINTON, IOWA.—A proposition has been made to the Service Company of Sioux City to extend transmission lines to this town, 12 miles, and furnish light. C.

DULUTH, MINN.—The West End Commercial Club is working to secure a "White Way" system on Eighteenth to Twenty-second Avenue W. on Superior Street. C.

GARDEN CITY, KANS.—It has been decided by the voters of Garden City to issue $40,000 in bonds for the purpose of erecting a municipal light and power plant.

CENTERVILLE, IOWA.—There is an agitation to construct a transmission line from Keokuk to this city to furnish electric light and power to the towns along the line. C.

PARSONS KANS.—A committee composed of H. H. Brown, L. J. Beagle and J. L. Waite, Sr., has been investigating the merits of municipal electric light plants.

WAXAHACHIE, TEX.—A committee from the Commercial Club of this city has been appointed to investigate the probable cost of installing an electric lighting plant.

SNYDER, TEX.—The Snyder Power & Light company has been organized here with a capital stock of $25,000. The incorporators are E. W. Clark, P. L. Fuller and M. A. Fuller. D.

PARIS, TEX.—The Texas Power & Light Company, which recently absorbed the property of the Paris Light & Power Company, is completing plans for a new plant with extensive improvements.

FRANKFORT, KY.—The Kentucky Public Service Company has under contemplation a number of improvements and extensions to be made in its plant, which now has a capacity of 750 kilowatts. G.

AU SABLE, MICH.——The State Railroad Commission has authorized a bond issue of $540,000 on the Au Sable Electric Company, which will be used in building new transmission lines and substations.

VALLEY JUNCTION, IOWA.—The City Council has under consideration the installation of a municipal electric light and water plant. It is estimated that such a plant can be installed for $40,000.

SOUTHBRIDGE, MASS.—The business men of Main Street are interested in obtaining better lighting for that street. It is understood that Solomon K. Blanchard is taking an active interest in the matter.

NORTON, VA.—The plans for a hydroelectric power plant site near here, in a district which is undergoing an industrial and railroad development boom, are in the hands of T. F. Suthers, of Norton. G.

NEWPORT BEACH, CAL.—Bids will be received up to December 30 for $25,000 worth of municipal light bonds, said bonds are of denomination $1,000, bearing interest at 5 per cent annually, payable semiannually.

PESOTUM, ILL.—The Central Illinois Public Service Company of Mattoon has purchased right of way from Mattoon to Pesotum, and has been given a contract by the Village Board to light the village streets.

LAKE CITY, MINN.—Preliminary plans and a report for the reconstruction of the electric light and water plant have been submitted. Charles P. Chase, consulting engineer, Clinton, Iowa, has the matter in charge. C.

EMINENCE, KY.—Harry Reed, of Versailles, Ky., representing Insull & Company, of Chicago, is negotiating for a franchise which will permit the interests to locate a good-sized electric light and power plant here. G.

PETERSBURG, IND.—This place is to have two electric lighting systems as soon as the McCaskey Company's plant is completed, this company having received a 20-year franchise for an improved system of lighting of Main Street.

ELKO, NEV.—Articles of incorporation have been filed for the Elko-Lamoille Power Company with $100,000 capital stock, by J. G. Scrughan, Frank Fernald, Sr., Webster Patterson, H. S. Taber, L. J. Wintermantel and G. G. McBride.

LEXINGTON, KY.—It is announced that when the new form of city government goes into effect, January 1, 1913, plans for a comprehensive ornamental street-lighting system throughout the retail business section will be completed. G.

LOUISVILLE, KY.—A number of motors suitable for operating paint mills will be purchased in the near future by the Progress Paint Manufacturing Company, of which John S. Strassel and others are the recent incorporators. G.

NASHVILLE, TENN.—The Tennessee Railway, Light & Power Company recently purchased a right of way at considerable expense in order to enable it to enter this city. The current is to be brought to the Tennessee capital in the immediate future.

GALESBURG, ILL.—The City Council has granted a 30-year franchise to Weinberg Brothers to manufacture and distribute electricity over certain streets, at a maximum rate of ten cents per kilowatt hour. The ordinance provides that the electricity must be manufactured in the city. Z.

ROCHESTER, MINN.—The Zumbrota Power Company has made a proposition to the city to construct a hydroelectric plant on the Zumbro River in the towns of Mazeppa and Zumbro, with 50-foot head, and turbines and generators of 1,000 kilowatts, to be increased as needed. C.

CEDAR POINT, KANS.—The Cedar Point Council is securing estimates on the cost of installing a municipal electric light plant and indications all point that one will be forthcoming for this town, and if so, Cedar Point will be the smallest town in the state to have a municipal electric plant.

DAYTON, O.—Two sub-stations or "booster houses" will be installed between this city and Xenia in the near

future, to enable the Dayton Light & Power Company to furnish power for the Dayton & Xenia Traction Company. The traction company will discontinue the use of its power house.

TERRE HAUTE, IND.—The County Commissioners have granted a 40-year franchise over all the roads in the county to the Terre Haute, Indianapolis & Eastern Traction Company for the erection of poles for stringing wires to be used in transmitting electricity for heating, lighting and power.

SOMERSET, KY.—The Kentucky Utilities Company, which recently bought the United Water, Light & Traction Company, will soon begin improvements to the local plant. Manager Waddle has stated that the company has ordered the construction of a new power plant, the cost of which will be about $75,000.

RICHMOND, IND.—The City Council is preparing to install a system of street lights in its municipal light plant. One light will be installed on each pole and no part of the lamp, as is the case with the cluster lamp, will cast a shadow over the other part. It is said this type will give more light and require less current. S.

MIDDLESBORO, KY.—It is understood that capitalists from Middlesboro and Pineville are negotiating a deal to construct a $1,000,000 power plant for Bell County. It is planned to locate this plant near the middle of the county and furnish power and light for all of the towns and coal mines within a radius of 40 miles.

SHARON, O.—The Councilmen have decided to refuse the proposition of the Mahoning & Shenango Valley Railway & Light Company to supply arc-light current and a municipal electric light plant will be installed. Bonds in the amount of $85,000 have been authorized by the people of Sharon, which is the estimated cost of the plant, with wiring, etc.

CINCINNATI, O.—A charter has been issued to the Terminal Construction Company with an authorized capital stock of $6,000,000. The incorporators are F. B. Enslow, R. M. Baker, J. William Hogen, Jr., N. H. Richardson and W. R. Fulton. The purpose of the company is to construct railroad terminals, and electric light and power plants.

MAQUOKETA, IOWA.—Ben R. Mowery has disposed of his holdings in the local electric light plant to the Maquoketa Light & Power Company, which has been incorporated under the laws of South Dakota. The incorporators are Ben R. Mowery and M. Taylor, Maquoketa; John Epps, Chicago; Edwin Emrich, Indianapolis, Ind., and James S. Sebree, Pierre, S. D. Z.

MUNFORDVILLE, KY.—The municipal authorities have agreed to contract for complete street lighting service from an electric light and power company which is to be organized in this city to establish a plant of considerable capacity. An unique provision of the contract which is pending is that the city lights are to be kept burning by the station "all night and every night except when the weather is clear and the moon is above the horizon."

NEW LONDON, CONN.—William E. Walker, of Norwich; Frank W. Browning, of Kitemaug, and Charles W. Comstock, of Montville, are petitioners for a charter for the Kitemaug Electric Light & Power Company, which proposes to construct a power plant at Kitemaug on the bank of the Thames River to supply electricity in several different towns. The plans of the company are to have a steam plant for the manufacture of electricity at first and later on harness the Thames River for the use of its water power to that end.

CHARLOTTE, N. C.—Plans for the construction of a new electric light and power plant costing approximately $1,000.000 have been completed by the Southern Power Company. The company will locate its new property at Shoals, N. C., 60 miles distant from Charlotte, on the Catawba river. The improvement has been necessitated by the increased load demanded in the Piedmont tobacco district, one of the richest manufacturing regions of the South. The addition which is being planned will give the Southern Power Company 148,000 horsepower in service in the Piedmont district. G.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

CUSTER CITY, S. D.—The Eldora Telephone Company will make improvements to its line. C.

RIALTO, CAL.—The Pacific Telephone & Telegraph Company has been granted a franchise here.

ROCK ISLAND, ILL.—The Tri-City Automatic Telephone Company has been voted a franchise. C.

AITKIN, MINN.—A telephone line is projected to Pine Knoll, Cedar Brook and Dean Lake districts. C.

LOS ANGELES, CAL.—The American District Telegraph Company has been granted a franchise in this city.

NAPA, CAL.—D. C. Priest has been granted permission to run a telephone line along the Howell Mountain road.

PERRY, IOWA.—A new common-battery-board system will probably be installed here by the Hawkeye Telephone Company. C.

CANADIAN, TEX.—The Southwestern Telephone & Telegraph Company will rebuild its exchange at this place at a cost of $10,000. Z.

OTTAWA, O.—The Public Service Commission has ordered the Putnam Telephone Company to make extensive improvements by March 1, 1913.

ST. CLOUD, MINN.—Manager C. H. Block of the rural telephone lines announces that another wire will be added in the spring to accommodate farmers. C.

COLUMBIA, S. C.—A charter has been issued to the Cross Keys Telephone Company, having a capital stock of $1,000. The incorporators are L. J. Browning and W. H. Wilburn.

LEWISTOWN, ILL.—The City Council has granted a 20-year franchise to the Fulton County Telephone & Telegraph Company to operate a telephone exchange in the city. Z.

MINNEAPOLIS, MINN.—The removal of poles and wires from ten more blocks in the center of town is recommended, and the expansion of the underground system by that amount. C.

MILES CITY, MONT.—Mr. Baldwin, of Jordon, Mont., proposes to raise funds for building a telephone line from Miles City to Jordon, about 100 miles. The estimated cost is $100 per mile. C.

PHILADELPHIA, PA.—The Telefunken Wireless Communication Company has been incorporated under the state laws of Pennsylvania with a capital of $5,000, by Alfred J. Ostheimer, New York.

CLARKSVILLE, TEX.—Clarksville Telephone Company has been incorporated with a capital stock of $25,000. The incorporators are J. F. Rochelle, R. B. Harrison, W. M. Bloxham and A. C. Stuart.

DENISON, TEX.—The Southwestern Telephone & Telegraph Company will, shortly after the first of the new year, begin the work of rebuilding its local and long-distance lines within the city limits of Denison.

LAUDERDALE, TENN.—The Bexar Telephone Company has filed articles of incorporation with a capital stock of $480. The incorporators are J. A. Bradford, J. W. Kebb, W. T. Andrews, S. B. Johns and A. A. Webb.

ELLIOTTSTOWN, ILL.—Union Telephone Company of Elliottstown has been incorporated with a capital stock of $5,000. The incorporators are F. M. Haynes, John W. Dobbins, W. H. Endebrook, J. S. Sipes and William Poe.

VIRGINIA, ILL.—Cass County Telephone & Telegraph Company has been incorporated with a capital stock of $25,000 to do a general telephone and telegraph business. The incorporators are E. J. Huff, Ada Huff and W. T. Gordley.

DOYLESTOWN, PA.—The Kingston Rural Telephone Company has been incorporated with a capital of $10,000 to operate in and around this place. The company is building a line to connect with the Bell Telephone Company's Doylestown exchange.

EMINENCE, KY.—The City Council has passed an ordinance authorizing the sale of a franchise to operate a telephone exchange in this city. It is thought probable that the two companies now operating in Eminence will be consolidated and purchase the franchise.

ELECTRIC RAILWAYS.

(Special Correspondence.)

MT. PLEASANT, IOWA.—The Burlington may electrify the line from Mt. Pleasant to Keokuk. C.

INTERNATIONAL FALLS, MINN.—The Council will consider applications for a street railway franchise. C.

DES MOINES, IOWA.—The Des Moines City Railway Company seeks a new franchise and proposes improvements to its system. C.

LINCOLN, ILL.—The City Council has granted a 25-year franchise to the Lincoln Street Railway Company to lay a track on Eighth and State Streets.

DUBUQUE, IOWA.—The City Council has granted a 25-year franchise to the Union Electric Company to extend its street car line into West Locust Street.

SCRANTON, PA.—Timothy Burke, who owns Moosic Lake, is promoting a trolley line to run from Moosic Lake to Lake Ariel and Hawley, a distance of about 12 miles.

NEW HAMPTON, IOWA.—An electric line is projected through Fredericks and Tripoli for a connection with the Waterloo, Cedar Falls & Northern at Dener Junction. C.

SAN JOSE, CAL.—The Peninsula

Railroad Company plans to push forward the work of rebuilding the electric line to Alum Rock Park, which was destroyed in a flood two years ago.

HACKETTSTOWN, N. J.— The Easton & Washington Traction Company is contemplating the extension of its system from Port Murray to Hackettstown, a distance of about 10 miles.

RICHMOND, CAL.—Bids will be received up to January 13 for a 42-year railroad franchise on McDonald Avenue and in the Canal subdivision, upon application of the San Francisco-Oakland Terminal Railway Company.

KNOXVILLE, TENN.—The Knox County Court has granted a franchise to the Knoxville Railway & Light Company over Kingstown Pike and the company will extend its lines to the Eastern Hospital, a distance of five miles.

THIEF RIVER FALLS, MINN.—Right of way has been secured and capital assured for the construction of 50 miles of electric line from the city into the country eastward, and at a meeting of citizens it was decided to proceed. C.

HUNTSVILLE, ALA.—The Alabama Power Company has agreed to introduce its current here as soon as possible. An electric railway which is now in course of construction from Nashville, Tenn., to Murfreesboro, will probably be extended to Huntsville.

ST. PAUL, MINN.—Electrification of the Great Northern's line from Lewistown, Mont., to New Rockford, N. D., is announced here, at a cost of $10,000,000. This comprises 530 miles of road being built by the Montana & Eastern Company and controlled by the Great Northern. C.

FULTON, MO.—The Fulton Commercial Club is interested in a proposition to build an electric line from Fulton to Steedman, to connect with the Missouri, Kansas & Texas. The prospects are that the line will be built for Fulton citizens have been wanting such an outlet for many years.

PRINCETON, IND.—A traction line is being promoted to branch off from the Princeton traction line at Patoka, four miles west of here, and run thence west ten miles to Mt. Carmel, Ill. Evansville capitalists are said to be behind the project and to have it well under way as to preliminaries.

WILLOWS, CAL.—The first contracts for the construction of the Sacramento Valley Electric Railroad will be let within three or four months. The road will be 160 miles long and will touch the principal towns on the west side of the Sacramento Valley. It is expected that the road will be completed within 14 months after work is begun.

HELENA, MONT.—The New Montana Power Company, incorporated in New Jersey, controls 96 per cent of the developed water power in the state, through absorbing power companies serving more than half the population, and negotiations are pending, it is said, to supply the Milwaukee road with power for electrification of its line through the state. C.

FRESNO, CAL.—There is a probability of an electric line being constructed from Fresno to the San Joaquin River through the Bullard lands. Negotiations looking toward the beginning of work on the line are now in progress, and a definite announcement as to plans will be made soon. The route will constitute the connecting link between the Bullard lands and the city. The line, if built, will run the entire distance to the San Joaquin River, terminating, probably, near the Riverside Club House. Power for the proposed line, presumably, will be furnished by the San Joaquin Light & Power Company.

TOLEDO, O.—It is announced that among the changes to result in the assumption by the H. L. Doherty Company, of New York City, of the property of the Toledo Railways and Light Company, are improvements and extensions in practically all departments of the plant. More than $1,000,000 will be spent in making these improvements in street railway, electric lighting, power and heating departments of the company. While it is known that the greater share of the improvement appropriation will be spent in the electric power department the exact nature of the betterments will not be determined until the engineers have made investigation. H.

PORTLAND, ORE.—Extension of the United Railways to Tillamook Bay, construction of a new line for the Oregon from the city limits to Tualatin with a tunnel through Elk Rock and double tracking the existing line between the city limits and Garden Home are some of the improvements, in addition to the extensive developments of the East Side terminal district, planned by the Hill lines for the approaching year. Joseph H. Young, president of the North Bank road and its affiliated electric, steam and water lines; Carl R. Gray, president of the Great Northern, and his predecessor in office, together with Louis W. Hill, chairman of the Great Northern Board of Directors, and Howard Elliott, president of the Northern Pacific, are working on the plans for the coming year's work.

OKLAHOMA CITY, OKLA.—Former Governor C. N. Haskell is now working on a new interurban proposition in Eastern Oklahoma. Mr. Haskell recently built a line from Muskogee to Fort Gibson and sold it to the Muskogee Electric Traction Company. The first step in connection with the new proposition will be the construction of a line between Checotah and Wainwright, later direct service being given from both towns to Muskogee, using the tracks of the Missouri, Oklahoma & Gulf railroad for a part of the distance. Arrangements have already been made with William Kenefick, president of the latter road, for the use of the tracks. An interurban line is also und rstood to be planned west out of Muskogee, which would eventually connect Muskogee and Tulsa. If that line is built it may be operated in connection with the extension of the line between Parsons and Coffeyville, Kans., which is expected to run on south from Coffeyville through Nowata, Collinsville and Tulsa. T. B. Higgins of St. Louis, who financed and built the Parsons-Coffeyville line, and Edward Rea, of Coffeyville, have been in consultation with the commercial clubs of Nowata, Collinsville and Tulsa in regard to the line. The power plant for the extension probably would be located at either Nowata or Collinsville on account of the plentiful supply of natural gas at those places. P.

FINANCIAL NOTES.

Emerging from a period of sluggishness and depression the stock market showed a stronger tendency than was hoped for at the beginning of the week. Trade reports were indicative of sustained activity.

The offering by Kelsey, Brewer & Company, New York City, of $2,200,000 six-per-cent preferred and $770,000 common stock of the American Public Utilities Company, was oversubscribed. The stock was offered for purpose of acquiring the Merchants' Public Utility Company and the People's Light & Heat Company, of Indianapolis, and the La Crosse (Wis.) Gas & Electric Company.

The stockholders of the Electrical Securities Corporation have authorized the increase of $500,000 in the common stock, making the total authorized, $2,500,000. The directors have declared a common stock dividend of 25 per cent payable in common stock to the holders of the common alone. The dividend is payable December 31, to stock of record December 24. The General Electric Company being the holder of all the common stock, will receive the entire dividend.

N. W. Harris & Company and Perry, Coffin & Burr, Boston, Mass., are jointly offering an issue of $1,200,000 Consumers Powers Company five-per-cent first-lien and refunding bonds at 97.5. The Consumers Power Company is a Michigan property, controlling the electric light and power business of a large portion of the state.

The Pacific Telephone & Telegraph Company will retire the $5,000,000 two-year five-per-cent notes due on January 5 from the proceeds of the sale of preferred stock to the American Telephone & Telegraph Company. Of the $32,000,000 six-per-cent, cumulative preferred stock authorized and issued by the Pacific Company, the American owns $21,727,200. Of the parent company's holdings of preferred stock, $18,000,000 was purchased just before the California public utilities law went into effect, and a portion of the proceeds of this sale will be used to retire the notes. The $750,000 Telephone & Telegraph first 6s, due July 1, 1913, will be taken care of by the sinking fund, while the $2,500,000 consolidated 5s of the same company will doubtless be called at 105 on October 1, 1913, from the proceeds of the sale of $3,000,000 unissued Pacific Telegraph & Telephone bonds.

Directors of the Kings County Electric Light & Power Company have voted to issue $2,500,000 of the $5,000,000 six-per-cent convertible bonds, authorized at a special meeting of stockholders November 26, and approved by the New York Public Service Commission December 17. The bonds will be dated March 1, 1913, convertible into stocks at par on and after March 1, 1916, and will mature March 1, 1925. Bonds are offered to stockholders of record December 31, 1912, payable at par, half on or before March 1, 1913, half on or before June 2, 1913. Stockholders are entitled to subscribe to $100 on bonds for each four shares of stock. The right to subscribe expires at noon March 1. Fractional warrants will be issued. Interest at six per cent from date of receipt will be allowed on all payments made on or before February 15. Stockholders may make payment in full on or before March 1, or on the first day of any month prior to June.

The prior-preference $3,000,000 seven-

per-cent cumulative preferred stock authorized by the recently incorporated $60,000,000 California Railway and Power Company has been sold to E. H. Rollins & Sons, of New York City.

It is understood that application by the bankers will be made to the New York Stock Exchange to list the prior preference stock. The United Railways Investment Company has received $6,874,400 seven-per-cent preferred stock and $40,000,000 common stock of the California company, these being the entire amounts issued at this time. The combined gross earnings of all the California properties included in the merger for the year ended June 30, 1912, were $9,379,303. The present organization of the California Railway and Power Company is only temporary, but it is expected that the permanent make-up of the new holding company will be announced shortly. The officers will probably be the same as those of the United Railways Investment Company.

The New York Stock Exchange governing committee has approved the listing of the following securities: Cumberland Telephone & Telegraph Company, $15,000,000 25-year first and general-mortgage five-per-cent coupon bonds, due 1937; General Electric Company, on and after January 2, next, $10,000,000 five-per-cent debenture bonds, due 1952, on official notice of issuance in exchange for outstanding temporary receipts, also $23,297,000 capital stock on official notice of issuance under terms of application.

Dividends.

American Power & Light Company; a quarterly preferred dividend of 1.5 per cent, payable January 2 to stock of record December 23.

American Public Utilities Company; a quarterly dividend of 0.5 per cent on the common, and 1.5 per cent on the preferred stocks, payable January 1 to stock of record December 20.

American Telephone & Telegraph Company; the regular quarterly dividend of $2 per share, payable January 15 to stock of record December 31.

Augusta-Aiken Railway & Electric Company; a quarterly preferred dividend of 1.5 per cent, payable December 31 to stock of record December 24.

Cities Service Company; a monthly preferred dividend of 0.5 per cent, and a monthly common dividend of one-third of one per cent, both payable January 1 to stock of record December 15.

City Railway Company; a regular quarterly dividend of 2.5 per cent and an extra dividend of 1 per cent, payable December 30, to stock of record December 18. A year ago 1.5 extra was declared. The total dividends this year are 11 per cent against 11.5 per cent last year.

Central & South American Telegraph Company, a quarterly dividend of 1.5 per cent, payable January 9 to stock of record December 31.

Colorado Electric Company; a semi-annual dividend of $3 per share, payable January 1 to stock of record December 21.

Consumers Power Company; a quarterly preferred dividend of 1.5 per cent, payable January 2 to stock of record December 20.

Electrical Securities Corporation; the regular quarterly dividends of 1.25 per cent on the preferred, payable February 1 to stock of record January 26, and two per cent on the common, payable December 30 to stock of record December 28.

Electric Storage Battery Company; the regular quarterly dividends of one per cent on the preferred, and one per cent on the common stocks, payable January 2 to stock of record December 21.

Massachusetts Lighting Companies; a regular quarterly dividend of 1.75 per cent, payable January 15 to stock of record December 26.

Metropolitan West Side Elevated; an initial dividend of 0.3 per cent on the common stock, and a dividend of 2.5 per cent, on the preferred, payable December 31, to stock of record December 20.

Mexican Telegraph Company; a quarterly dividend of 2.5 per cent, payable January 16 to stock of record December 31.

Public Service Corporation of New Jersey; the regular quarterly dividend of 1.5 per cent, payable December 31, to stock of record December 27.

Reading Traction Company; a semi-annual dividend of 1.5 per cent, payable January 1 to stock of record December 21.

Republic Railway & Light Company; the regular quarterly dividend of 1.5 per cent on its preferred stock, payable January 15 to stock of record December 31.

South Side Elevated Railway; a dividend of 1.5 per cent, payable December 31 to stock of record December 20.

Southern California Edison Company; the usual quarterly dividend of 1.25 per cent on the preferred stock, payable January 15, to stock of record December 31.

United Gas & Electric Company; a semi-annual dividend of 2.5 per cent, payable January 15 to stock of record December 31.

Westinghouse Electric & Manufacturing Company; the regular quarterly dividends of 1.75 per cent on the preferred and 1 per cent on the common stocks; the preferred dividend payable January 15, and the common dividend payable January 30, both to stock of record December 31.

Reports of Earnings.

UNITED STATES LIGHT & HEATING COMPANY.

The United States Light & Heating Company reports for the fiscal year ended June 30, 1912, as follows:

Net shipments	$1,835,976
Manufacturing costs	1,187,100
Gross profits	648,875
Selling and operating expenses	290,800
Net profits	358,075
Other income	7,950
Total income	366,025
Reserve	10,129
Surplus	*355,895

* Equal to seven per cent on $2,500,000 preferred stock, and an additional 1.2 per cent on $15,000,000 common.

LEHIGH VALLEY TRANSIT.

The Lehigh Valley Transit Co. reports for the year ended Nov. 30, 1912, as follows:

Passenger receipts	$1,242,007	$1,141,133
Net earnings	591,928	548,680
Surplus	374,442	294,676

CENTRAL & SOUTH AMERICAN TELEGRAPH.

The Central & South American Telegraph Co. reports partly estimated earnings for the quarter ended December 31, 1912, as follows: Gross, $387,500; net, $239,000; other income, $4,892; total income, $243,892; dividend, $143,565; surplus, $100,328.

MEXICAN TELEGRAPH.

The Mexican Telegraph Company reports for the quarter ended December 31, 1912, partly estimated, as follows: Gross, $214,000; net, $171,500; other income, $34,360; total income, $205,860; Mexican government portion, $11,000; dividends, $89,735; surplus, $105,125.

STANDARD GAS & ELECTRIC COMPANY.

A condensed balance sheet of the Standard Gas & Electric Company, as of November 30, 1912, and the company's earnings statement for the year ended November 30th, is being mailed to stockholders. Copy of the report follows:

Condensed balance sheet, November 30, 1912.

ASSETS.

Securities owned	$31,811,369.12
Cash, interest and dividends receivable	584,264.40
Bond interest deposited	309,000.00
Organization expenses	42,094.15
Premium on bonds and coupon notes redeemed	168,500.00
Other Sundry assets	14,048.50
	$32,929,276.17

LIABILITIES.

Bonds	$10,300,000.00
Preferred stock	11,004,950.00
Common stock	9,343,150.00
Interest and dividends accrued	526,530.72
*Notes payable	649,194.99
Surplus	1,105,450.46
	$32,929,276.17

* This indebtedness was mainly incurred to temporarily finance additions and betterments of the San Diego Consolidated Gas & Electric Company and the Western States Gas & Electric Company and will be liquidated shortly when the application of these companies to issue securities has been approved by the Railroad Commission of California.

Earnings statement twelve months ended November 30, 1912.

Gross earnings	$2,269,757.89
Expenses	38,605.05
Net earnings	$2,231,152.84
Interest charges	612,780.11
Available for dividends	$1,618,372.73
Preferred stock dividends	850,606.56
Surplus	$767,766.17

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Dec. 21.	Dec. 16.
American Tel. & Tel. (New York)	140½	139
Commonwealth Edison (Chicago)	142½	143
Edison Electric Illuminating (Boston)	280	279
Electric Company of America (Philadelphia)	*12¼	12¼
Electric Storage Battery common (Philadelphia) (ex dividend)	52¼	53¼
Electric Storage Battery preferred (Philadelphia) (ex dividend)	52¼	53¼
General Electric (New York)	184½	180¼
Kings County Electric (New York)	129	129
Manhattan Transit (New York)	1⅝	1⅝
Massachusetts Electric common (Boston)	17	16¼
Massachusetts Electric preferred (Boston)	75	72¼
National Carbon common (Chicago)	120	120
National Carbon preferred (Chicago)	117½	117¼
New England Telephone (Boston)	153	151
Philadelphia Electric (Philadelphia)	24	23⅝
Postal Telegraph and Cables common (New York)	82	80⅞
Postal Telegraph and Cables preferred (New York)	65½	65½
Western Union (New York)	*73⅜	72½
Westinghouse common (New York)	80¼	76
Westinghouse preferred (New York)	117½	117½

*Last price quoted.

PERSONAL MENTION.

H. M. BYLLESBY was the author of an article in the *New York Commercial* of December 14 entitled "The Great Problem of the Public-Service Corporation."

R. M. STANLEY made an address before the Minnesota Section of the American Institute of Electrical Engineers on December 9, the subject being "Substations." The talk was illustrated with lantern slides.

W. F. M. GOSS, dean of the College of Engineering of the University of Illinois, was elected president of the American Society of Mechanical Engineers at the annual meeting of that body held recently in New York City.

LELAND HUME and T. D. WEBB have been elected vice-president and treasurer, respectively, of the Cumberland Telephone & Telegraph Company and the Southern Bell Telephone Company, with headquarters at Nashville, Tenn.

CHARLES F. RICHARDSON, of Brazil, Ind., has tendered his resignation as manager of the Brazil Division of the Terre Haute, Indianapolis & Eastern Traction Company, to become general manager of the Southern Illinois Railway & Power Company, Harrisburg, Ill.

GEORGE H. HARRIES, vice-president of H. M. Byllesby & Company, gave an interesting talk on "The New Partnership" at the annual dinner of St. Mark's Church, Minneapolis Minn., which was held recently. His address was well received and has been favorably commented upon.

W. H. BROWN, manager of the Red River Power Company, Grand Forks, N. D., has been requested to make an address upon the subject "Problems of the Public-Utility Corporation" at the convention of the Society of Engineers to be held at Bismarck, N. D., February 13 and 14.

JOHN HUNTER, chief engineer of power plants of the Union Electric Light & Power Company, St. Louis, Mo., was elected president of the Engineers' Club at its annual banquet held at the City Club on December 18. Mr. Hunter has the hearty congratulations of his many friends, who are highly pleased that he has been so signally honored after such a brief residence in St. Louis.

ROBERT E. HUGHES, president of the Kentucky Electric Company, Louisville, Ky., celebrated his forty-third birthday anniversary on December 20 by entertaining a few friends at luncheon at the Seelbach Hotel. A 43-candlepower incandescent lamp mounted upon a mammoth cake was placed in front of Mr. Hughes to his surprise, and as a joke the cost of the cake, including a cost for charging, motor installation, etc., was put on Mr. Hughes's bill.

HARVEY C. GARBER, who for several years has been identified with the telephone and telegraph business, has severed his connection with that industry to associate himself with the Ralston Steel Car Company, of which he has been elected to the Board of Directors and appointed vice-president, with offices in both Columbus, O., and New York City. Mr. Garber was assistant to the president of the Central Union Telephone Company for many years, later having charge of the company's pending legislative business in different parts of the country.

OBITUARY.

RUDOLPH ROTH, of Dayton, O., well known in Ohio as a railroad electrician, was instantly killed recently in an accident which occurred near Seattle, Wash.

WILLIAM H. HORNBERGER, president of the Hornberger Transformer Company, Lafayette, Ind., died suddenly at his home on December 13. Mr. Hornberger was very well known as an electrician and manufacturer, and was at one time connected with various industries in South Bend, Elkhart and Aurora.

HERMAN SAMUEL, president of the Kingsbury-Samuel Electric Company, of Baltimore, Md., died suddenly on December 13 in the fifty-fifth year of his age. He was one of the pioneers in electrical work in Baltimore and was very popular among his fellow contractors. The funeral was held on December 16 from his late residence in that city.

PROPOSALS.

ELECTRICAL CABLE AND CONDUITS.—Sealed proposals will be received by the Navy Department, Bureau of Supplies and Accounts, Washington, D. C., until January 14, 1913, for furnishing 500 feet of electrical cable, and 750 feet of conduit to be delivered at the Navy Yard, Boston, Mass., as per Schedule 5073.

ELECTRIC PASSENGER ELEVATOR.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until January 6, 1913, for an electric passenger elevator in the post office at Portland, Me. Copies of drawings and specifications may be obtained from the office of the Supervising Architect.

ELECTRIC APPARATUS.—Sealed proposals will be received at the office of the United States Reclamation Service, Los Angeles, Cal., until January 22, 1913, for furnishing hydraulic and electrical apparatus for St. Mary's storage unit, Milk River project, Mont. Further particulars may be obtained by addressing the above department.

TRANSMISSION LINE.—Sealed proposals will be received at the office of the United States Reclamation Service, Los Angeles, Cal., until December 31 for furnishing line material for the Roosevelt-Mesa transmission line, Salt River project, Ariz. Proposals will be considered on one or more items of the schedule. For particulars address the above department.

ELECTRIC GENERATOR, ETC.—Sealed proposals will be received at the office of the Secretary, United States Department of Agriculture, Washington, D. C., until December 31 for furnishing at the power house of this department an electric generator and bed plate. Specifications and full information may be obtained from the chief clerk of this department.

CONDUIT AND WIRING.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until January 8 for furnishing a conduit and wiring system, gas piping and lighting fixtures for the custom house, Norfolk, Va., in accordance with drawings and specifications, copies of which may be obtained from the office of the Supervising Architect.

ELECTRIC CONDUIT AND WIRING AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., until January 28, 1913, for the electric conduit and wiring and interior lighting fixtures of a two-story building for the post office at Elkins, W. Va., and until January 30 of a one-story building for the post office at Bellafontaine, O. Drawings and specifications may be obtained from the custodians of the sites or from the office of the Supervising Architect.

NEW INCORPORATIONS.

PITTSBURGH, PA.—Baden Electric Company has been incorporated with a capital stock of $5,000 by H. C. Dennison and W. A. Weiland, of Bellevue.

SEWARD, PA.—Seward Electric Company has been incorporated with a capital stock of $5,000 by J. W. Blough, H. E. Thompson and R. C. Saylor, all of Johnstown.

JOHNSTOWN, PA.—New Florence & Okeville Electric Company has been incorporated with a capital stock of $5,000 by J. W. Blough, H. E. Thompson and R. C. Saylor, Johnstown.

TOLEDO, O.—The La France Electrical Construction & Supply Company has been incorporated with a capital stock of $10,000 by Otto G. Knigge, Richard W. Kirkley, G. E. Smith and Frank H. Geer.

PITTSBURGH, PA.—Yough Hydro-Electric Company has been incorporated with a capital stock of $5,000 by U. W. Tinker, of Pittsburgh; L. C. Lamb, of Knoxville, and G. T. McConnell, of Millvalle.

CHICAGO, ILL.—The Inland Electric Company has been incorporated with a capital stock of $50,000 for the purpose of manufacturing and dealing in electrical supplies. The incorporators are John D. Clancy, George B. Cohen and John E. Anderson.

NEWARK, N. J.—The Dean Electric Company has been incorporated with a capital stock of $50,000 to continue the electrical contracting business of William W. Dean. The incorporators are William W. Dean, Helen L. Dean and Edward A. Quayle, Jr.

HARRISBURG, PA.—Articles of incorporation have been filed in the State of Pennsylvania for the intended incorporation to be called John Wendt & Company, capitalized at $10,000, to deal generally in gas and electric fixtures. John Wendt is the incorporator. N.

CHICAGO, ILL.—Interstate Equipment Manufacturing Company has been incorporated with a capital stock of $5,000 for the purpose of manufacturing and dealing in electrical supplies and devices. The incorporators are Henry H. Russell, Joseph W. Fay, Harry C. Kribs.

ST. LOUIS, MO.—The Ross Power Company has filed articles of incorporation with a capital stock of $20,000 to manufacture, buy, sell and deal in engines, machinery, boilers and complete power houses. The incorporators are John W. Mackey, Edgar D. Weiss and Robert M. Zeppenfeld. Z.

INDIANAPOLIS, IND.—The Gray Engine Starter Company has filed articles of incorporation with a capital stock of $300,000. The object of this association is to manufacture starters for engines of any and all kinds, and reduction and other gears, etc. The directors are Robert C. Light, Thomas J. Gray, Henry N. Spain, William Bosson and Henry Rosenberg. S.

NEW PUBLICATIONS.

ELECTRIC DEVELOPMENT MONTHLY.—Beginning with January, 1913, the Electric Development Association will issue a monthly magazine to be known as *The Silk Cord*. It is planned to be educational and sales influencing. Advertising from manufacturers will not be solicited. The subscription price of the magazine is $1.00 per year, but copies may be obtained in bulk at a price not to exceed four cents each. The magazine will be edited by Zena W. Carter and will be published at 53 State Street, Boston, Mass. The object of this publication is to spread the news of the great progress which electricity has made and the tremendous development which it has made possible. Reference to technical terms will be avoided as far as possible. The first issue will contain 16 pages.

HENDRICKS' COMMERCIAL REGISTER.—The twenty-first annual revised edition of Hendricks' *Commercial Register* of the United States for buyers and sellers, which has just been issued, covers a comprehensive listing of architectural, engineering, electrical, mechanical, railroad, mining, manufacturing and kindred trades and professions. The total number of classifications in the present volume is over 50,000, and the present issue contains over 1,500 pages. An important feature of the *Commercial Register* is the simplicity of its classifications. They are so arranged that the book can be used for either purchasing or mailing purposes. Considerable information is given respecting the trade names and descriptions of the material classified, thereby eliminating for the purchaser a good deal of useless letter writing. The price of this book is $10.00.

CLASSIFICATION OF ENGINEERING DATA.—University of Illinois Engineering Experiment Station has issued a revised edition of Bulletin No. 9, entitled "An Extension of the Dewey Decimal System of Classification Applied to the Engineering Industries," by L. P. Breckenridge and G. A. Goodenough. The filing and classification of engineering data has become a matter of much importance, and this bulletin was prepared for use as a guide in carrying out such work. It presents subdivisions of subjects in such detail as to constitute a complete classification for even those engineering industries which are highly specialized. The revision has been made in accordance with the 1911 edition of "Decimal Classification," by Melville Dewey. This edition is not subject to gratuitous distribution, but a charge of 50 cents is being made.

DATES AHEAD.

American Association for Advancement of Science and affiliated societies. Annual meeting, Cleveland, O., December 30-January 4, 1913.

Northwestern Cedarmen's Association. Annual meeting, Duluth, Minn., January 7-8, 1913.

South Dakota Independent Telephone Association. Sioux City, S. D., January 8-9, 1913.

American Institute of Consulting Engineers. Annual meeting, Engineers' Club, New York, N. Y., January 14, 1913.

Illinois Electrical Contractors' Association. Annual meeting, Peoria, Ill., January 17-18, 1913.

Peoria Electrical Show. Peoria, Ill., January 18-25, 1913.

Ohio Engineers' Society. Columbus, O., January 21, 1913.

Electrical Contractors' Association of New York State. Annual meeting, Syracuse, N. Y., January 21, 1913.

Western Association of Electrical Inspectors. Annual meeting, St. Louis, Mo., January 28-30, 1913.

National District Heating Association. Fifth annual convention, Indianapolis, Ind., May 27-29, 1913.

With the Electrical Manufacturers

The Federal Sign System (Electric), Chicago, Ill., announces that its San Francisco offices and factory have been consolidated at 257-269 Eighth Street.

Lloyd Garratt Company, manufacturer, of gas and electric fixtures, has opened a new retail salesroom on the northeast corner of Fifteenth and Locust Streets, Philadelphia, Pa.

Robert W. Hunt & Company, inspecting, testing and consulting engineers, have removed their Chicago offices and laboratories to the twenty-second floor of the new Insurance Exchange Building, where they invite inspection of their commodious quarters.

Graner-Mahoney Contracting Company, St. Louis Mo., has had a most successful year in its work as conduit contractor. An installation for the Bell Telephone Company of St. Louis has just been completed. This consisted of laying conduit in a section of the city where the conditions were such as to require especial care.

Automatic Electric Company, Chicago, Ill., maker of the Raven enameled wire, announces that although its facilities for manufacturing this product have recently been doubled, the entire output has already been contracted for by the Supply Sales Department. The company will install more machinery in order to handle the future demand.

Appleton Electric Company, Chicago, Ill., reports that the president of the company, A. I. Appleton, made a recent trip through the East and found business conditions very promising. The demand for Appleton specialties has never been so great as at the present time. Appleton unilets have met with especial favor among contractors.

The Delta Star Electric Company, 617 West Jackson Boulevard, Chicago, Ill., is distributing bulletin No. 11, entitled "Gas Street Lighting Transformed to Series Mazda Lighting." This bulletin gives a good description of the underground system now operating in Chicago and should prove of value to central-station managers confronted with gas competition.

H. T. Paiste Company, Philadelphia, Pa., has issued its catalog of 1913 Paiste pipe taplets, which are standard iron fittings used in connection with wiring in iron conduit to provide convenient openings in such work for lamp outlets, for switches, for branches, for pulling in wires, etc. They are made in six sizes, which require only three sizes of covers. The catalog illustrates the great variety of these taplets and of the combinations to which they readily adapt themselves and gives complete data respecting them.

The Cravens Electric Company, 12 South Jefferson Street, Chicago, announces that it has recently been appointed selling agent for the C. & C. Electric & Manufacturing Company, Garwood, N. J., in Chicago and vicinity. The territory covers Northern Illinois and Indiana, Southern Michigan and Wisconsin and Eastern Iowa. In this field the Company will handle motors, dynamos, electric welding sets, printing-press and elevator motors and controllers, heating and ventilating motors and other direct-current machinery made by the C. & C. Company. This company also acts as selling agents for the Eastern Electric Lamp Company, of Boston, Mass. Cravens Electric Company is confining its own manufacturing activities to the production of switchboards, distribution panels, disconnecting switches, choke coils and other power-controlling apparatus. It has recently enlarged its manufacturing facilities and is now in a position to make shipments in from one-half to one-fourth the usual time.

A. Hall Berry, New York, N. Y., is sending out a unique folder in the form of a United States mailing card, describing the "Hartford" time switch, which automatically and accurately turns electric current for any purpose on and off. Particular attention is called to its simplicity of construction. It includes an eight-day marine clock movement. Its switching mechanism is standard and of the highest quality. The casing is handsomely finished in hard-baked black japan with rubber-gasketted door, locking with subtreasury lock. It is dust and weatherproof. Each switch is thoroughly inspected and tested before shipment, thus guaranteeing perfect operation. It is supplied in various standard types to meet every requirement of lighting and current control, and its capacities are 10 to 200 amperes, with single, double or triple pole. The company assures its patrons of prompt shipment, the best service and satisfaction.

Fort Wayne Electric Works of the General Electric Company announces the removal of its Cincinnati district office from the Union Trust Building to Rooms 704 and 705 in the Provident Bank Building. This removal was necessitated by a fire on the night of December 10, which practically destroyed the old quarters, as well as the Gibson House, an adjoining hotel, which was one of the largest and oldest in the city. About half of the tenants of the Union Trust Building were driven, by the fire, from that structure, which was the first skyscraper built in Cincinnati. This company announces that its New Orleans office has closed a contract with the City Light and Water Commission, Donaldsonville, La., for a new central-station equipment. The contract covers two 150-kilowatt, 200-revolutions-per-minute, three-phase, 60-cycle, 2,300-volt, revolving-field alternators, direct-connected to Diesel engines; one eight-panel switchboard series incandescent regulators and transformers; four 75-horsepower, 2,300-volt slip-ring-type motors for direct connection to 500-gallons-per-minute pumps operating against 100 pounds pressure furnished by Lawrence Pump & Engine Company; one 20-horsepower, 440-volt motor for direct connection to 250-gallons-per-minute pump operating against 50 pounds pressure furnished by the same company; and one 25-horsepower motor for direct connection to air compressor for use with Diesel engines.

Record of Electrical Patents.

Issued by the United States Patent Office, December 17, 1912.

1,047,151. Elevator-Controlling Apparatus. W. Baxter, Jr., assignor to Otis Elevator Co., Jersey City, N. J. An automatic elevator controlled by push-buttons. Relays at the different floors.

1,047,157. Device for Determining Direction. D. M. Bliss, Stamford, Conn., assignor of one-half to C. J. Henschel. A dynamo armature is rotated in the magnetic field of the earth and supplies current to a duplex indicator.

1,047,158. Dynamo-Electric Machine. C. E. Bonine, assignor to Electro-Dynamic Co., Bayonne, N. J. Has only half as many interpoles as main poles.

1,047,176. Cross-Arm. L. L. Crabtree and T. C. Ripley, Sulphur Springs, Tex. An inverted-U-shaped sheet-metal arm adapted to have a longitudinal extension fitted into it.

1,047,235. Electric Arc Lamp. A. D. Jones, London, Eng. A regenerative flame lamp with curved draft tubes and condensing chambers to provide circulation for the gases.

1,047,245. Electric Switch. G. C. Knauff, Chicago, Ill. Covers details of a spring-switch mechanism.

1,047,255. Traction-Elevator System. D. L. Lindquist, assignor to Otis Elevator Co. Relates to the electric brake magnets.

1,047,260. Electric Circuit-Controller. R. H. Manson, assignor to Dean Electric Co., Elyria, O. For controlling a street lamp-signal circuit.

1,047,264. Automatic Fire-Alarm System. A. H. McNeil, assignor to The Associated Fire Alarms, Ltd., London, Eng. Detector piping is connected with an electric alarm circuit.

1,047,272. Combined Electrical and Mechanical Brake for Elevator. E. W. Moon, assignor to Otis Elevator Co. Duplex brake for a pulley.

1,047,276. Speed-Controlling Device. B. G. Nelson, Milwaukee, Wis. The pointer and an adjustable pin for a speedometer are connected to a speed-limiting electric circuit.

1,047,277. Electrical Switch. A. P. Nichols, Seattle, Wash. The switch blades are mounted on rotatable disks.

1,047,279. Agitator Implement. F. J. Osius, Racine, Wis. Is driven by a vertical electric motor.

1,047,293. Telephone Attachment. M. M. Reynolds, New York, N. Y., assignor to American Independent Telephone Co. For holding the receiver to the user's ear.

1,047,294. Telephone Instrument. M. M. Reynolds, assignor to American Independent Telephone Co. A modification of the above which dispenses with switch-hook and substitutes a rotatable contact-making receiver holder.

1,047,299. Dental and Surgical Lamp. C. F. Rogers, Conneaut, O. An electric light concentrator and projector.

1,047,329. Electromagnetically Controlled Power-Transmission Mechanism. A. Sundh, assignor to Otis Elevator Co. Electric control for the valves of an automobile.

1,047,330. Traction Elevator. A. Sundh, assignor to Otis Elevator Co. Has leather facings for the cable and motor-driven sheave.

1,047,334. Telegraph System. B. F. Thompson, Arlington, Md. Is supplied from an alternating-current source at each end.

1,047,353. Electric Illuminating Body. G. Weissmann, Paris, France. An incandescent-lamp receptacle.

1,047,372. Electric Switch. H. R. Bickford, Monterey, Cal. Has a closing device actuated by a ratchet, cam and levers acting against a spring.

1,047,395. Searchlight Projector. E. A. Edmonds, Mare Island, Cal. Is rotated and tilted by means of electric motors.

1,047,414. Electrical Switch. B. D. Horton, assignor to Detroit Fuse & Manufacturing Co., Detroit, Mich. A fused switch inclosed in an iron case and operated by an external lever.

1,047,415. Circuit-Controller. S. P. Hull, Yonkers, N. Y. A longitudinally shiftable operating bar carries switch contacts in different planes.

1,047,417 and 1,047,418. Electrically Heated Cooker. A. J. Kercher, assignor to Berkeley Electric Cooker Co., Berkeley, Cal. A heat-insulated vessel with heating element near the bottom, water above this and a steam-pressure-controlled switch for the heater.

1,047,429. Cloth-Cutter. H. A. Meyer, assignor to Wolf Electrical Promoting Co., Cincinnati, O. A motor-driven knife with an auxiliary grinder.

1,047,433. Drop-Light Support. C. W. Morningstar, Marion, Mich. Includes a reel for winding up the slack cord.

1,047,463. Supporting and Controlling Mechanism for Electric Switches. J. S. Thompson, Mill Valley, Cal. For high-tension outdoor switches.

1,047,474. Train Controlling and Signaling System. E. Wittlake, Hanover, Germany. An electric air-brake-applying and audible and visual signal system.

1,047,502. Art of Manufacturing Lamp Filaments. W. D. Coolidge, assignor to General Electric Co. A large number of filaments are treated at once by passing a regulated current through them.

1,047,520. Lava Vapor-Tube. J. L. R. Hayden, assignor to General Electric Co. Is made of self-glazed lava.

1,047,523. Clamping Ear for Trolley Wires. C. J. Hixson, assignor to General Electric Co. Consists of two hinged jaws and an expander.

1,047,524. Contact Terminal for Interrupting Electric Circuits. G. Honold, assignor to Firm of Robert Bosch, Stuttgart, Germany. For ignition circuit of gas engines.

1,047,525. Portable Electric Light. C. Hubert, New York, N. Y. A contact button for a flashlight.

1,047,536. Temperature-Regulating Device. A. J. Kercher, assignor to Berkeley Electric Cooker Co., Berkeley, Cal. As soon as the temperature of an electric hot plate reaches a certain maximum the switch is opened.

1,047,540. Manufacture of Tungsten Filaments for Incandescent Electric Lamps. A. Lederer, Atzgersdorf, near Vienna, Austria-Hungary. The filaments are made from a paste of benzidin tungstate, tungsten oxide and an organic filament.

1,047,541. Support for Metallic Glow-Filaments for Electric Incandescent Lamps. A. Lederer, Atzgersdorf, Austria-Hungary. Is made from refractory oxides impregnated with difficultly fusible metal.

1,047,545. Apparatus for the Production of High-Potential Electric Currents. D. G. McCaa, Lancaster, Pa. Direct current is supplied to a pole-changer and condenser and then to the primary of a step-up transformer.

1,047,546. Hanger for Trolley Wires. W. A. McCallum, Cincinnati, O. An inverted cup filled with insulating material in which the trolley-ear support is imbedded.

1,047,553. Chimney Jacket. A. Newell, Decatur, Tex. About a vessel's chimney is a rotatable jacket insulated therefrom, piercing of the jacket and chimney by a shot closes the circuit for a motor that moves the jacket to bring the shot holes out of alinement.

1,047,557. Electrical Low-Speed Cut-out. M. F. Owens, assignor to Automatic Refrigerating Co., Hartford, Conn. The motor circuit is controlled by the speed governor of the driven machine.

1,057,560. Signaling Apparatus for Hospitals. W. M. Perry and A. E. Boozer, Columbia, S. C. Includes electric pilot lights, extension pilot lights,

individual room-call lights, switches, etc.

1,047,563. Time Mechanism for Operating Valves, Switches, and the Like. C. Prichard, Seattle, Wash. The alarm arbor of a clock releases a weight, whose sudden dropping operates the switch lever.

1,047,568. Electric Chain. W. H. Riess, Cincinnati, O. One-half of each link is hollow to receive the fixture cord.

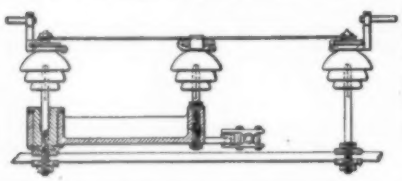
1,047,573. Apparatus for Electrical Ignition Systems. M. Schafer and R. Wagner, assignors to Firm of Robert Bosch, Stuttgart, Germany. Relates to the distributer and a rotable brush therefor.

1,047,575. Electric Switch. F. Schneider, assignor to Van Dorn & Dutton Co., Cleveland, O. A rotary spring switch controlled by two interlocking push bars.

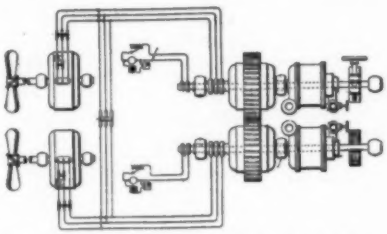
1,047,593. Turbo-Electric Ship Propulsion. E. Thomson, assignor to General Electric Co. The turbine shafts are connected to the revolving fields of generators, whose armatures are geared together and may also be revolved to change the frequency supplied to the induction propelling motors.

1,047,643. High-Frequency Oscillator. A. A. Jahnke, San Francisco, Cal., assignor to National Wireless Telephone & Telegraph Co. Includes a spark gap between carbon and metallic electrodes submerged in alcohol.

1,047,667. Coin-Prepayment Substation Telephone. G. W. Lorimer, assignor to Western Electric Co. Of the "nickel-first" type.



1,047,463.—Outdoor High-Tension Switch.



1,047,593.—Turbo-Electric Ship Propulsion.

1,047,682. Electric Rat-Trap. A. Morawski, Tariffville, Conn. Opposed electrodes are carried by rotatable blades in a cylinder.

1,047,692. Trolley. J. Para, Elizabeth, N. J. Has guard and guide rollers for keeping the wheel from leaving the wire.

1,047,709. Globe-Holder. E. F. Rueckert, Providence, R. I. Includes an expanding band to engage the shade.

1,047,711. Motor Actuating Device for Registering Machines. W. F. Schweiger, assignor to National Cash Register Co., Dayton, O. An electric motor rewinds a spring.

1,047,720 and 1,047,721. Apparatus for Making Coils. R. Varley, assignor to Varley Deplux Magnet Co., Jersey City, N. J. A number of coil formers have tape-guiding pockets.

1,047,742. Electrical Resistance. F. Buchanan, Syracuse, N. Y. Relates to the interconnection of the resistance units.

1,047,744. Arc-Light Cutout. C. L. Bundy, assignor to Philadelphia Electrical & Manufacturing Co., Philadelphia, Pa. Removal of a plug from a casing opens the circuit.

1,047,759. Means for Maintaining the Lateral Equilibrium of Aeroplanes. T. R. da Paz and A. M. C. de Faria e Maya, San Miguel, Azores. Includes a reversible electric motor with gravity-controlled circuit-closers.

1,047,772 Self-Locking Knife Switch. C. J. Embree, assignor to Inventors Development Co., Chicago, Ill. A plunger locks the blades in open or closed position.

1,047,788. Telephonic Apparatus. E. A. Graham, London, Eng. A loud-speaking receiver.

1,047,810. Electric Time Indicator and Alarm. F. Hope-Jones, London, Eng. Includes an electromagnetically oscillated lever with a driving click.

1,047,821. Dynamo-Electric Machine. J. C. Macfarlane and H. Burge, assignors to Crompton & Co., Chelmsford, England. The field poles are divided radically into two parts, each with a separate coil.

1,047,827 Electrically Operated Balancing Mechanism for Aeroplanes. R. L. Monroe, Sioux City, Ia., assignor of one-half to J. W. Monroe. Solenoids control auxiliary balancing planes.

1,047,833. Apparatus for Automatically Connecting Up the Subscribers of Telephone Exchanges. J. Peticky, Prague, Austria-Hungary. Describes the automatic selector switches.

1,047,844. Winding Machine. A. D. Scott, assignor to Varley Duplex Magnet Co. For winding spark coils or the like.

1,047,855. Electrical Temperature-Recorder. M. E. Taylor, Ashtabula, O. Includes a thermostatic bar and contact maker.

1,047,856. Motor Drive for Calculating Machines. O. Thieme, assignor to Moon-Hopkins Billing Machine Co., St. Louis, Mo. A constantly rotating motor drives the machine through friction wheels.

1,047,858. Turbo-Electric Propulsion of Vessels. E. Thomson, assignor to General Electric Co. A modification of No. 1,047,593, in which the turbines drive the revolving fields of the generators and the rotating armatures of the latter drive the propellers.

1,047,881. Regenerative Device for Roentgen Tubes. H. Bauer, Berlin, Germany. A gas vent and filter is connected with a branch of the tube.

1,047,891. Ignition Apparatus for Large Internal-Combustion Engines. G. Honold, Stuttgart, Germany. Each cylinder has two spark plugs in series.

1,047,899. Coil-Former. R. Varley, assignor to Varley Duplex Magnet Co. Gives details of the coiling mandrel.

1,047,907. Electric Gas-Cock. T. J. Litle, Jr., assignor to Welsbach Light Co., Gloucester City, N. J. Electromagnets operate a valve through a cam.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired December 24, 1912.

551,755. Switch-Operating Mechanism. J. P. Coleman, Swissdale, Pa.

551,757. Electrically-Operated Elevator. F. B. Corey, Boston, Mass.

551,781. System of Electrical Distribution. T. F. Mullaney, Worcester, Mass.

551,785. Electric Brake. W. B. Potter, Schenectady, N. Y.

551,786. Lightning Arrester. W. B. Potter, Schenectady, N. Y.

551,790. Machine for Connecting Electric Conductors. H. J. Savory, Somerville, Mass.

551,795. Electrogalvanic Belt. S. J. Spalding, Canton, O.

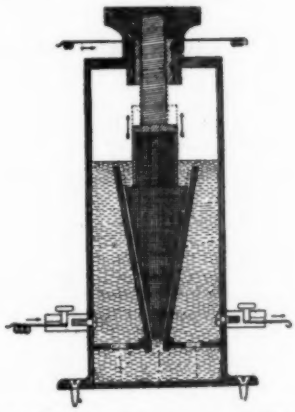
551,799. Electric Arc Lamp. E. Thomson and C. E. Harthan, Swampscott, Mass.

551,809. Converting Simple into Polyphase Alternating Currents. C. S. Bradley, Avon, N. Y.

551,810. Alternating-Current Motor. C. S. Bradley, Avon, N. Y.

551,820. Mechanism for Operating Elevator-Controlling Mechanism. F. E. Herdman, Winnetka, Ill.

551,863. Alternating-Current Machine. M. Hutin and M. Leblanc, Paris, France.



1,047,643.—High-Frequency Oscillator.

551,880. Electrical Eye-Cup. T. B. Wilcox, Newark, N. J.

551,920. Electric Stop-Motion for Machines for Preparing Sliver. W. P. Canning, Lowell, Mass.

551,930. Electric Railway-Train Signaling. W. S. Greene, Covington, Ky.

551,942. Electric Latch Apparatus for Semi-Automatic Operation of Railroad Signals. H. C. Barnes and W. W. Slater, Oakland, Cal.

551,946. Art of Recording and Reproducing Impulses. W. H. Cooley, Brockport, N. Y.

551,947 and 551,948. Electric Telegraph. W. H. Cooley, Brockport, N. Y.

551,951. Automatic Temperature-Regulating Apparatus. C. L. Fortier, Milwaukee, Wis.

551,982. Station Potential Indicator. R. D. Mershon, Pittsburgh, Pa.

551,996. Pedo-Electric Trolley. R. T. Oney, Charleston, W. Va.

551,998. Electric Signal. E. M. Phelps and A. T. Sampson, Lynn, Mass.

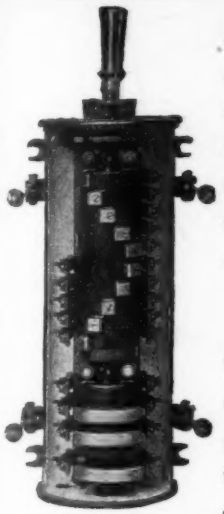
552,001. Underground Current-Supply for Electric Railways. A. Rast, Nuremburg, Germany.

552,013. Apparatus for Heat Regulation. J. V. Stout, Easton, Pa.

552,053. Electrical Switch-Operating and Signal Apparatus. J. Dutrey, New Orleans, La.

552,057. Circuit-Closer and Breaker. J. R. Farmer, St. Louis, Mo.

552,073. Store-Service Apparatus. J. C. Reuter, Englewood, Ill.



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In addition to being well constructed mechanically and electrically, our devices contain a number of new and exclusive features others have been unable to duplicate.

If you are not familiar with our apparatus you surely will find it decidedly advantageous to get n touch with us.

Let us tell you more about it.

All types of AC and DC Controlling Devices.

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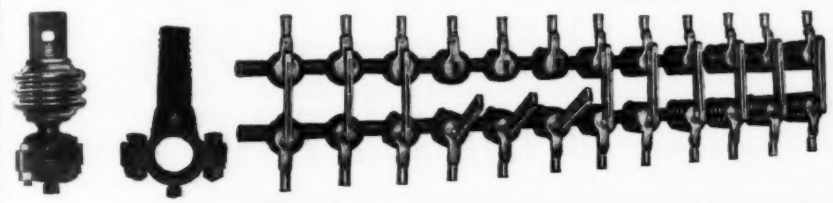

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of any kind furnished by us at the lowest market prices. The following list will give an idea of the material and supplies carried in stock.

Cut-outs	Motors	Switches	Globes
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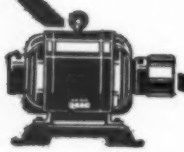

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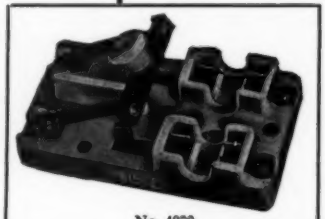

No. 4030

using N. E. Code Enclosed Fuses (approved for 250 volts) and Entrance Switches using Plug Fuses (approved for 125 volts) are all in the Paiste Line. We make them right in every way: Strength, Design, Price.

Are you on our mailing list for our bulletin "Paistery?" This keeps you informed as to what is newest and best. Let us know.

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"Union" Made means *well made*

The constantly increasing sales of ***Union Sockets*** is proof that they are giving satisfaction. If you are not using ***Union Sockets*** begin at once. Send for sample. A better way, let us send you a trial order. If they are not satisfactory return them at our expense.

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Prevent dusting and subsequent damage to generators and all machinery. A hard, glossy, durable surface that is oil proof and easily cleaned.

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SEE our Interesting Announcement in the Electrical Review and Western Electrician of December 7, page 17, on

Universal Insulator Supports

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Electric Railway Line Material, Charging Plugs and Receptacles, Ajax Lightning Arresters, Switches and Switchboard Appliances, Automatic Time Switches.

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For ALL PURPOSES
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THE WILLARD STORAGE BATTERY CO.
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Modern Street and Factory Illumination

Demands Steady, Uniform, High Candle Power Light

Columbia Solid Flame Carbons, for all types of long burning flaming arc lamps, give pure white or yellow light. There is no flickering. The life is long. There are no lamp outages from slagging.

Free samples will prove these statements.

Write today, giving type of lamp in which they will be used.

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P & S sockets with shadeholder attached do not cost much more than the ordinary socket with the cheapest kind of a shadeholder, but give you a whole lot more satisfaction.

You can depend upon your shadeholder setting straight on the socket. It will not wobble as there are no screws to come loose.

The shadeholder is rigidly attached to the socket.

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San Francisco Gas & Electric Co. Have Purchased Their Third Gould Stand-by Battery

Big companies like this never guess nor make snap judgments. It is significant therefore that after installing and thoroughly testing Gould Stand-by Batteries in *two* plants, this company decided to install another 152-cell Gould Battery in a *third* plant. The capacity of the latest battery is as follows:

For 60 minutes 4170 amperes or at this rate 1125 kilowatts
For 20 minutes 8340 amperes or at this rate 2200 kilowatts
For 10 minutes 12500 amperes or at this rate 3125 kilowatts

Ask for figures on a Stand-by Battery for your own plant
32

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THE UNITED STATES LIGHT AND HEATING CO.

Storage Batteries

are worthy of your consideration. Fourteen years of manufacturing experience enables us to produce a battery that will give you maximum service.

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Electric Bond and Share Company

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Dealers in Proven Electric Light, Power and Street Railway Bonds and Stocks.

Simplex Electric Toaster

Uses least current for the same work.
The only toaster that does not curl the slices or scatter the crumbs.
The "Keep-Hot" Rack increases its capacity. Removable doors confine the heat and assist cleaning.
Heavy nickel or silver plated—black enamel base—an ornament to the finest table.
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Here's What a Few More Electric Vehicle Users Say About The "Ironclad-Exide" Battery

The Improved Cloth Sponging Works
Cleveland, Ohio

Aug. 27, 1912.

"We wish to say that we had very good results from our "Ironclad" Batteries in our trucks that have been in our service since the 15th day of January, this year, and had no trouble as to batteries or trucks.

"These batteries were sold to us for a 55-mile charge while we had as high as 82 miles from a charge and we are well satisfied."

Muskogee Gas & Electric Co.
Muskogee, Okla.

Aug. 28, 1912.

"The one "Ironclad" battery which we have in service has been in use about one year. The same has given us no trouble and required but very little attention. And while the truck has made from 20 to 30 miles a day, the battery is in excellent condition and I believe will last another year."

J. & J. Slater
New York City

Sept. 11, 1912.

"Relative to the service that we have had of the "Ironclad" batteries purchased from you a year ago, we have no hesitation in saying that this is the best service we have had and do not think that any battery could have done more or better work under the conditions."

Edison Electric Illuminating Co.
of Brooklyn

Sept. 13, 1912.

"As to the service we are getting from the "Ironclad" Battery, which we purchased from you, we are pleased to advise you that it has given us entire satisfaction.

"Since we installed your battery the car has not as yet finished weak at the end of the day, which was not the case before we installed your battery. Your battery was installed in our car and put in service in October, 1911, and since date of installation of that battery, car has traveled approximately 7,169 miles."

Anheuser-Busch Brewing Ass'n
St. Louis, Mo.

Aug. 24, 1912.

"With respect to our experience with "Ironclad-Exide" Batteries, would say that the seven "Ironclad-Exide" Batteries we have in our service are doing good work and even more than we expected them to do. I think so well of them that in ordering four new 5-ton trucks I have specified all to be equipped with 19 MV "Ironclad-Exide" Batteries. I know of no better battery made. The batteries which I have already mentioned have been in active service for more than a year, and expect to get a great deal more service out of them.

Globe Storage & Carpet Cleaning Co.
New York City

Sept. 11, 1912.

"In regard to the "Ironclad-Exide" storage battery would say; our battery has been in use about eleven months and up to date it has given and is giving excellent service.

"We had some trouble at first with the battery because we were afraid to charge it heavily enough, we did not realize the lead battery was so nearly foolproof.

"We estimate the mileage to be about 3,000 miles for the past eleven months' service.

"This battery replaced ..... battery, which was worn out and, of course, the "Ironclad-Exide" has been a great improvement over that."

Union Elec. Light & Power Co.
St. Louis, Mo.

Aug. 26, 1912.

"In reference to "Ironclad-Exide" Batteries, beg to say that we have been agreeably surprised as to the performance of these batteries. The claims you make for them we have not found to be extravagant, and one good feature of the battery is that the more it is used the better satisfaction it gives."

Bernheimer & Schwartz Pilsener Brewing Co.
New York City

Sept. 11, 1912.

"In answer to your favor of the 10th inst., beg to say that we have one of your "Ironclad-Exide" Batteries since January of this year.

"We have altogether seven trucks equipped with "Ironclad-Exide" batteries and they have all given us good satisfaction."

The West End Storage Warehouse
New York City

Sept. 7, 1912.

"We have used the "Ironclad" Battery in our one (1) ton electric since April 6, 1911, during which time this vehicle has covered 6,000 miles, and in our two (2) ton since April 25, 1911. This vehicle has covered 6,400 miles.

"Up to the present time these batteries have given us entire satisfaction and they will equal in mileage as much on one charge now as at any time since we have had them."

American Museum of Natural History
New York City

Sept. 11, 1912.

"I would say that the "Ironclad" battery was installed in our machine on May 6, 1911. Since that time the machine has covered a distance of approximately 1,470 miles. Last winter was the first time that we have had no trouble through the batteries giving out. There have been no leaky cells, no corroded terminals, and we have been able to make forty-five miles on one charging of the battery. This battery has given us entire satisfaction."

Runkel Brothers
New York City

Sept. 11, 1912.

"We have an "Ironclad" battery in operation in Chicago for one year, the same has never been washed, and its efficiency is greater today than it was when we first started to operate the battery. The car using this battery has gone over 11,000 miles."

Valley City Milling Co.
Grand Rapids, Mich.

October 5, 1912.

"We purchased from you an "Ironclad" for our 5-ton truck shortly after "Ironclad" batteries were placed on the market. The battery has proven so good that we have since placed orders with you for "Ironclad" batteries for our 3-ton truck, also our 2-ton truck.

"This type of battery is very efficient and has continued to improve with constant use. Much to our surprise and satisfaction we are getting a greater mileage out of our "Ironclad" batteries today than when the same was first installed."

THE ELECTRIC STORAGE BATTERY CO.

Manufacturer of

The "Chloride Accumulator" The "Tudor Accumulator"

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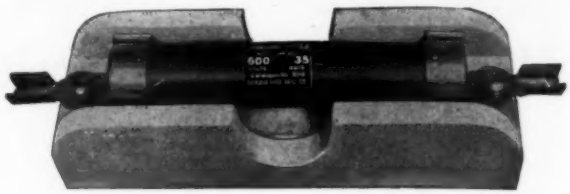
Whether for smallest 'phone circuit or heaviest transmission line, safeguard lives and property with



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National Electrical Code Standard

They give maximum protection, operating on overloads without fail and with positive promptness; their rating is guaranteed accurate; each fuse is tested before leaving the factory.

Note ample metal contacts, preventin undue heating and the consequent inactivity of the heated fuse wire.

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THE STANDARD
HEAT RESISTING
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Unequalled for telephone and bell wiring. The fibre insulation prevents troublesome short circuits and grounds.

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No-90-With cover in position

Approved by Underwriters

in position on moulding line

Facilitates and improves the making of branch taps in wood moulding.
For two or three wire branches or any combination thereof.
Indispensable to good work.

Brass contacts are liberally designed; wires once placed under binding screws cannot slip off contact plate or be removed without loosening binding screw.

Porcelain cover so arranged that capping extends under same, allowing capping to be installed on moulding before cover of Tap-On is placed in position.
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"Noark" Primary Fuse Boxes successfully withstand severe service conditions. Each box is tested at 400 per cent. of its working voltage. These boxes are made water and weather proof by means of rubber gaskets under the cover—you could turn a hose on them without getting a drop inside. They are fitted with porcelain fuse carrier handle and fuse block, insuring safety during operation. Made with bushings on side or ends; also unions on side or ends.

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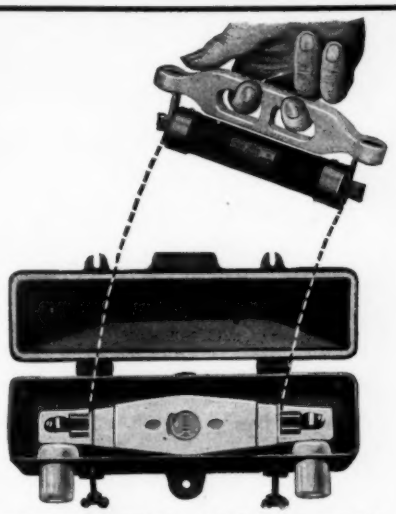

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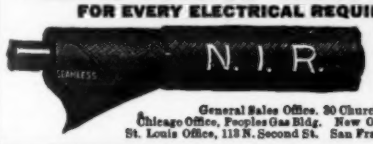

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RUBBER COVERED WIRE
(WORSTED TRACER THREAD)
TYPE R. S.
FOR 600 VOLTS OR LESS.

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Guaranteed to be a strictly high grade Insulated Wire.
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Braids	
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Test No.	
Feet	

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TRADE TURNS TO QUALITY

and that is the reason why HABIRSHAW "RED CORE," New Code and Special Wires, as well as HABIRSHAW Signal, Underground, Mine, Torpedo and Submarine Cables exclusively are used in many of the most important installations in the country.

Nothing enters into HABIRSHAW products but the best grade of Lake copper, the finest quality of rubber and insulating materials, and the highest grades of cotton yarns and finishing compounds.

Samples, reports of test and records of performance, as well as list of noted installations sent for the asking.

Get HABIRSHAW insulation and you get the best

HABIRSHAW WIRE COMPANY

Offices: Metropolitan Tower, New York. Works: Yonkers, N. Y.

Belden Rubber-Covered Wire

MADE IN CHICAGO

"Beldenite" 1911 N. E. C. S.

BELDEN MANUFACTURING COMPANY

Offices and Factory
2304 So. Western Avenue
CHICAGO

The James Goldmark Co.

General Sales Agents
83 Warren St., N. Y.

Sole Agents For

CROSS INSULATED STAPLES
The Perfectly Insulated Staple—Low in Cost.

NEW ENGLAND MAGNET WIRE
Copper Braids and Pigtails, Office and Annunciator Wire.

TROTTERS COMMUTATOR COMPOUND
On the Market for Years—Well Known to the Trade.

STAR WOVEN WIRE DYNAMO BRUSHES
Well Known to the Trade.

KILFYRE, Dry Powder Fire Extinguisher, will extinguish Electric Arcs of 2000 Volts.

DOLPHIN An "Atlantic" Brand for Commercial Code Wire

High dielectric strength and great resiliency characterize also the latest Atlantic product—"Dolphin" Insulation. Built on the same lines as the widely known and used Atlantic Brands "Neptune" and "Triton."

DOLPHIN ATLANTIC

TRITON ATLANTIC
High Grade

Atlantic Insulated Wire and Cable Co.

New York Office:
120 Liberty Street

Factory:
Stamford, Conn.

NEPTUNE ATLANTIC
Extra High Grade

2024-0

Safety Ruby Core

The New Code Wire of Superior Durability

is packed in heavy pulpboard cartons, 500 feet in each carton, ten to the case. The contents are plainly marked on both ends of each package. Besides guarding the wire against damage during shipment and storage, the carton packing greatly facilitates handling and simplifies stock keeping. The cartons are oil-proof and strong enough to withstand rough treatment. This method of packing is part of our policy of ***service*** and the added cost to us is charged to that policy.

The Safety Insulated Wire & Cable Co.

114 Liberty St., New York

M. B. Austin & Co.,

Managers Western Dept.

700-710 Jackson Blvd., Chicago

BRANCHES IN

Atlanta, Boston, San Francisco

The Greatest Advance in the Solution of the Lighting Problem

since the invention of the carbon lamp about 20 years ago, has been made by the

INDEPENDENT TUNGSTEN LAMP

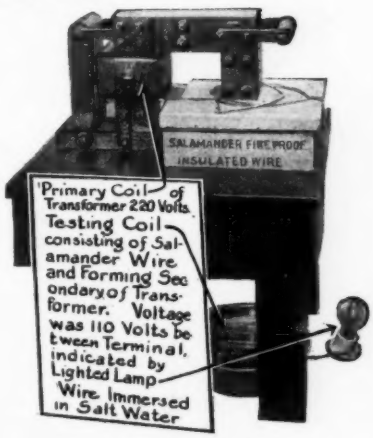
It has greater utility than the carbon lamp.

If the filament is broken, it will frequently fuse again, if the globe be gently tapped, and will burn as before, while a broken carbon filament ends the usefulness of the lamp.

It gives a white light, resembling daylight more closely than anything yet produced by human ingenuity.

There is no deterioration in quality of light, whereas, the carbon lamp gives a weaker and yellower light the longer it burns.

It effects a saving of 75 per cent in current for the same candlepower.


SALAMANDER FIREPROOF INSULATED WIRE
Primary Coil of Transformer 220 Volts.
Testing Coil consisting of Salamander Wire and Forming Secondary of Transformer. Voltage was 110 Volts between Terminal, indicated by Lighted Lamp.
Wire Immersed in Salt Water

Field and Armature Coils Subjected to Heavy Overload Made Permanently Fire-Proof with

SALAMANDER

Pure Asbestos Insulated Magnet Wire

Make your machinery that is subjected to heavy overloads or high temperatures safe at all times with Salamander Fireproof Wire. Constructed of the indestructible asbestos—It gives the greatest protection at the smallest cost at all times. Indestructible equipment is a necessity—Salamander Fireproof Wire makes yours a reality, is approved and used by the United States Government and in many of the largest Central Stations in the country.

Write for booklet Yours for the asking.

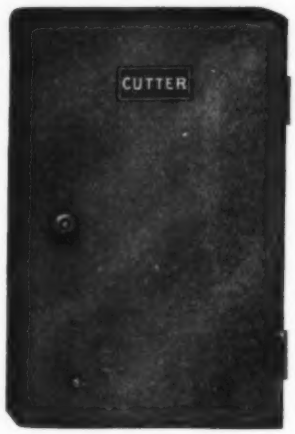
Independent Lamp and Wire Co.

1733 Broadway - - - - New York

Works: York, Pa., and Weehawken, N. J.

Cutter Steel Service and Cutout Boxes

The Box Without a Rivet



These boxes are made of two pieces of sheet steel formed up and welded together at the corners. They have hinges welded on and every operation in making the boxes is done by modern machinery. This allows us to offer them at exceptionally low prices.

Write for Price List

George Cutter Company

407 Notre Dame Street

SOUTH BEND INDIANA

Oldest on the Market — Youngest in Improvements

How can you do good conduit work without

Bossert Boxes

Patented Nov. 10, 1896
No 571297.

Economy and strength combine to make Bossert Knockout Boxes the world's standard for rigid conduit, flexible conduit and armored conductors. They may be used in a great number of positions on account of their wide range of adaptability. So strong that careless workmen or settling walls will not injure the boxes.

Shall we send booklets?

The Bossert Company

Utica, N. Y.

BAKELITE

Reg. U. S. Pat. Office

The Synthetic Insulating Substance

Why use
resinous compounds
when Bakelite

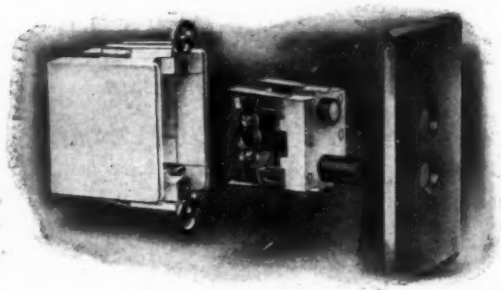
IMPREGNATED COILS

withstand a temperature of 500° F

Withstands oils, steam, solvents and chemicals. High Dielectric Strength. Ask us about other applications.

GENERAL BAKELITE CO.

100 William St. New York



METROPOLITAN DETACHABLE MECHANISM FLUSH SWITCHES

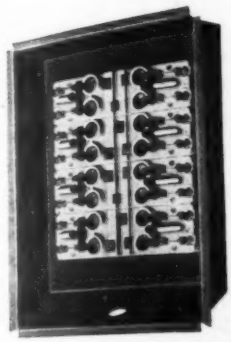
not only save the expense you incur when you are called upon to replace switches damaged during building construction, but they also place you in the "high grade" contracting class because the job is perfect. You install your outlet box when you pull the wires—keep the mechanism and plate in their separate boxes until all danger of damage is over. See the benefits? Then write now for catalog and Net Price List.

METROPOLITAN ELECTRIC MFG CO.

East Avenue and 14th Street, Long Island City, N. Y.

P. L. HOADLEY - - - 530 First Ave. So., Seattle, Wash.
I. A. BENNETT CO. - - - 565 Van Buren St., Chicago, Ill.
McCLEARY HARMON CO. - 423 Stevens Bldg., Detroit, Mich.
SWEETEN & O'DONNELL 1213 Race St., Philadelphia, Pa.

Reduced Prices on Security One-Piece Metal Boxes!



That statement in itself should cause you to investigate.

Improved manufacturing conditions—and big volume of business make it possible to save you *more money*.

Here is your chance for *big profits*.

Quantity orders shipped from stock. 263 stock sizes.

As to Security Iron Box quality, most contractors know about that—there is no better, we guarantee it.

Box Bulletin Number Seven gives New Prices—Write for it today!

The F. Bissell Company
226 Huron Street,
Toledo, Ohio

TOLEDO, OHIO. THE F. BISSELL COMPANY TRADE MARK

Three-quarter Front View

Side View Showing Enclosed Mechanism

Electrical and Mechanical Perfection

Are qualities built into "Diamond H" Switches that have made them famous wherever switches are used. Remember that the trade-mark is our guarantee to you. Assure yourself of this protection when buying switches. *Ask for Catalog.*

The Hart Mfg. Co., Hartford, Conn.

TRADE H MARK

New York Boston Pittsburgh Chicago Toronto Denver London, Eng. San Francisco

Send for it Today

Ask for your copy; the booklet was gotten up for you, and you are entitled to a copy

For Linemen, Wiremen and Electricians and their employers as well. Sent free on request.

Jobbers and Dealers ought to have it too.

MATHIAS KLEIN & SONS
Canal Station 28
CHICAGO

MATHIAS KLEIN & SONS, Canal Station 28, Chicago
Please send me your new Pocket Tool Guide

Corinthian Standard Patented

A Live Truth

JUDGMENT is based on experience.

Thus reason.

We have 20 years' experience in Ornamental Iron and Bronze.

The Corinthian Standard is the result of all our work.

NOW YOU KNOW! Nine

Flour City Ornamental Iron Works

Minneapolis, - Minnesota

WESTERN ELECTRIC CO., Selling Agents

Offices in All Principal Cities.

A PROFIT PROPOSITION

That's exactly what handling the

GILL PATENTED TUNGSTEN REFLECTORS

will mean to you—they are so brilliantly beautiful that they don't stay long in the store—("duplicate my order for the ***easy selling*** Crystal Reflectors" writes one dealer)—the heavy winter lighting load is coming on—do you want to be prepared to furnish the best reflectors on the market?

Write now and get our liberal proposition

GILL & CO. (INC.)

Phila., Pa.

THE LUX MFG. CO. TRADE FLEXILUX MARK N.Y.C. NEW

FLEXIBLE FILAMENT TUNGSTEN LAMP

FOR ALL CONDITIONS

TOUGH, DURABLE AND EFFICIENT

LUX MANUFACTURING COMPANY

50-52-54 GROVE STREET

TEL. 2151-2152 SPRING NEW YORK CITY

ARIES

This is the season to sell fixtures—complete your stock and be ready to meet the dark-day demand.

The Faries line will meet your customer's every requirement, including, as it does—Patented Adjustable Brackets, Portables and Shades, Electric, Gas and Combination Fixtures, Fittings and Mazda Clusters. ¶ New catalog now ready. Write for it at once.

FARIES MFG. CO.

DECATUR, ILL.

FIXTURES

A Satisfied User

The Guarantee Protects You

Manhattan Electrical Supply Co.

New York

Chicago

St. Louis

BENJAMIN COMMERCIAL FIXTURES

Benjamin Commercial Fixtures

For Store-Front Lighting

The Benjamin line of commercial lighting fixtures includes not only the highly efficient mill and shop clusters for interior lighting, but a number of special designs pre-eminently the fixtures for striking store-front lighting. This is a branch of the lighting field which has been neglected by contractors and central stations—the *profits beckon!*

Three styles—ready to hand—any length arms—any finish—for Tungsten lamps from 150 to 500 watts.

Inform yourself by getting our new Lighting Bulletin No. 11

Benjamin Electric Mfg. Co.

San Francisco Chicago New York

"Real Lamps"

"EXCELLO-DIA"

100 to 125 hours

for alternating current service, 25 to 133 cycles, two on 110-120 volts, four on 220-240 volts, white or yellow light. This is the latest development of the "Excello" idea and embodies in its design and construction the results of years of experience in flaming arc lamp design and manufacture.

The "Excello-Dia" is of the "fixed-point" type, differentially controlled. The combustion chamber is separated from the lamp proper, and being air-tight, the carbons burn under conditions of least oxygen, and therefore maximum of illumination is maintained during the entire life of the carbons. The long hours of efficiency reduce maintenance expense.

The Old Reliable "EXCELLO" No. 197

The first flaming arc lamps imported into this country were of this type. Two of them are today giving splendid service in front of McVicker's theatre in Chicago. This model No. 197 has a diverging carbon feed, which diffuses the light where needed, and a deposit-free globe maintains maximum illumination during the entire period of burning. For large area lighting "Excello" Flaming Arcs are unexcelled.

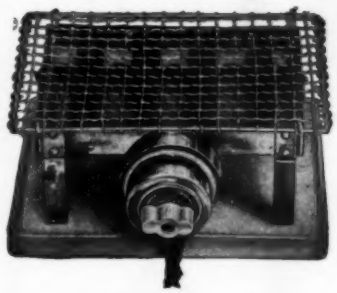
Koerting & Mathiesen Co.

Sole-American Distributor

22 E. 21st St., New York

Western Office: 630 W. Adams St. Chicago

Delco Electric Household Specialties



Delco Toasters equipped with plug, green silk cord and "On" and "Off" Switch are of dainty appearance.

An intense heat is generated which insures a delicious piece of crisp toast, the bread being colored an even brown in less than two minutes, thus quickly converting the starch into dextrine.

An ideal gift for any time of year.

Diamond Electric Co.

7-17 Frederick St.

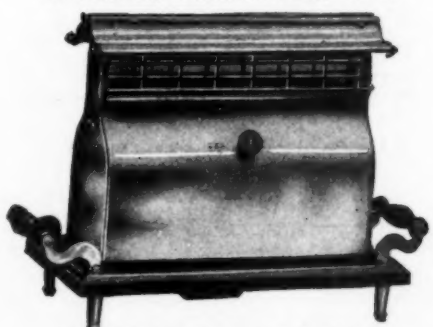
Binghamton, N. Y.

HELION

Electrically Heated Appliances

Ready Sellers at Good Profits *for Central Stations, Dealers, Jobbers and Contractors. Write for prices—discounts are liberal. Helion resistance material will withstand a temperature of 3100 degrees F. without exhibiting any changes in chemical or mechanical characteristics.*

PRACTICAL, ENDURING XMAS GIFTS



Helion Radiant Toaster, Price, $3.50

For Special "Campaign" Proposition, Literature and Discounts, address, **HELION ELECTRIC COMPANY**

Sherman Ave. and Runyon St., NEWARK, N. J.

FLAMING EXCELLO CARBONS TRADE MARK

More Light and Better by the use of the right CARBONS

"EXCELLO" & "ELECTRA"

FLAMING EXCELLO CARBONS TRADE MARK

The two brands of imported carbons ***never*** vary in quality.

"EXCELLO" Carbons for Flaming Arcs produce a steady and brilliant light. Their patented metal vein construction reduces system to a minimum, with the result that higher candle power is obtained than through the use of other carbons.

"ELECTRA" Carbons have demonstrated their superiority for enclosed arcs. "ELECTRA" Carbons are of uniform diameter, straight, and of a fine grained, smooth and pure composition.

The Test of Use is Convincing. Write at Once.

ELECTRA TRADE MARK

HUGO REISINGER

Sole Importer of "Electra" & "Excello" Carbons

11 BROADWAY • NEW YORK

ELECTRA TRADE MARK

The readiest seller you ever saw. Lists at $8.00; dealers' discount gives big margin of profit.

Franks Adjustable Mirror
WITH REFLECTOR

Here is a practical combination of the well known Franks ball and socket adjustable with a mirror and six C. P. lamp. The reflector makes a complete revolution around the circumference of the mirror —any position desired is obtainable at the touch of a finger. No manipulation of set screws or clamps is necessary to adjust either mirror or light. Show a sample, sales will follow.

Write us today for literature and discount sheet

FRANKS MANUFACTURING COMPANY
Rock Island, Ill.

What Service Do You Expect On Lighting Fixture Shipments

If you get less than the maximum service offered by the House of Beardslee, then your competitor **who does get it** has you at a disadvantage.

By "Maximum Beardslee Service" we mean twenty-four hour shipments on goods listed in Catalog S-2 and a saving of from five to ten days over the usual delivery on all other fixtures.

Beardslee Service Always Superior

In addition to this superior shipping service, the House of Beardslee offers you the best quality of material; workmanship that insures a satisfied customer, and designs that instantly attract the favorable attention of the best class of buyers.

Catalogs No. 21 and S-2 will give you a line of fixtures that meet all requirements. The former illustrates the more expensive patterns; the latter illustrates patterns that will appeal to the taste and pocketbook of the average customer.

Send for your copies today, if you haven't one of each.

BEARDSLEE CHANDELIER MANUFACTURING CO.
220 S. Clinton St. Chicago, Ill.

What for the Year 1913?

Well, in the first place—THE NEW YEAR'S NUMBER of ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, January 4, 1913.

Start right. A big impressive announcement in a big impressive issue.

Incidentally, you cannot do a better thing than make up your mind right now for *continuous* representation in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.

If you knew what the managers of the central stations all over the country, the supply men and jobbers, the contractors and dealers, and in fact practically every one devoted to the electrical industry as a business, were writing us of their appreciation of the value of weekly visits of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN to them, you wouldn't hesitate a minute to present a message in every issue to this great buying power.

Let us write and tell you all about it.

Forms close for NEW YEAR'S NUMBER December 31st. Order space now.

Electrical Review and Western Electrician

Chicago

13 Park Row, New York **Buhl Block, Detroit**

New Year's Number

Electrical Review and Western Electrician

January 4, 1913

Review of Electrical Developments in the United States during 1912.

Approximate Value of Electrical Manufactures Produced in 1912.

Review of Electrical Developments in Great Britain.

Review of Electrical Developments on the Continent.

Electricity in Ice Making.

Electrical Construction.

List of Approved Fittings.

Buyers' Guide of Electrical Material.

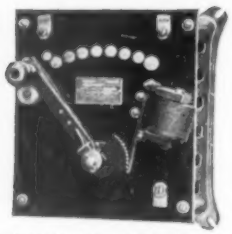
A Big Start for a Big Year. The readers of the ELECTRICAL REVIEW and WESTERN ELECTRICIAN are the Everyday Users of Electrical Material. They are always in the market. Your advertisement in this important issue reaches an interested and friendly audience.

Forms Close December 31. Send Your Copy and Cuts Today.

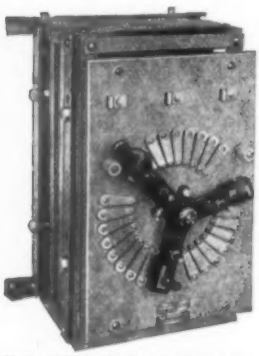
Electrical Review and Western Electrician
Chicago

13 Park Row, New York **Buhl Block, Detroit**

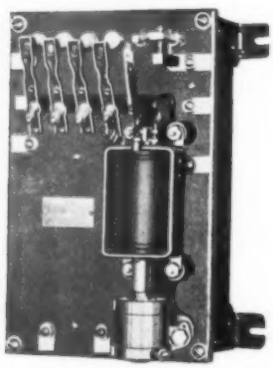
CUTLER-HAMMER



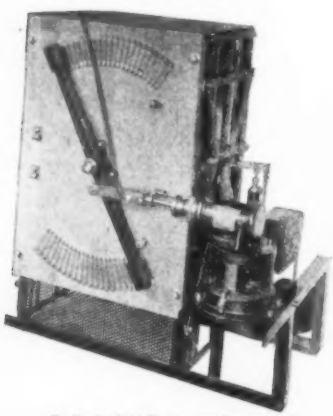
Bulletin 3110 Speed Regulator for Ventilating Fans, etc.



Bulletin 9320 A. C. Speed Regulator



Bulletin 6105 Self-Starter



Bulletin 3310 Pressure Controlled Automatic Speed Regulator

Controllers for Pumps and Ventilating Fans

Many installations of motor-driven pumps and fans require controllers somewhat out of the ordinary because of special requirements. The standard Cutler-Hammer controllers for fire-pump service and for mine pump and fan duty have been designed by engineers who have made a study of this work and are familiar with all the engineering requirements.

What bulletins do you wish?

BULLETINS ON ALTERNATING CURRENT CONTROLLERS

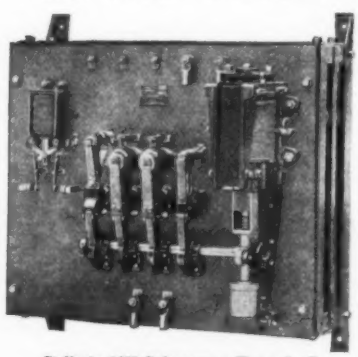
(For D. C. Bulletins see Ad in last week's issue)

	Bulletin Number
A. C. Speed Regulators:	
Panel Type Speed Regulators for Single Phase Motors	9300
Drum Type Reversible Speed Regulators for Single Phase Motors	9305
Panel Type Speed Regulators for Slip Ring Motors	9320
Drum Type Speed Regulators without Primary Switch	9365
Pressure Controlled Speed Regulators	9370
Organ Blower Speed Regulators	9375
A. C. Solenoid Switches for Automatic or Remote Operation:	
Double Pole Solenoid Operated Switches, Magnetically held	9580
Double Pole Solenoid Operated Switches, Mechanically held	9581
A. C. Self Starters:	
Self Starters (Across the Line Type) for Single Phase or Polyphase Squirrel Cage Motors	9600
Self Starters (Resistance Type) for Squirrel Cage Motors	9610
Self Starters (Resistance Type) for Single Phase Motors	9615
Self Starters (Transformer Type) for Squirrel Cage Motors	9620
Self Starters for Slip Ring Motors, driving Reciprocating Pumps	9630
Self Starters for Slip Ring Motors, driving Centrifugal Pumps	9640
Self Starters (Schureman Type) for Single Phase Motors	9660
Self Starters (Schureman Type) for Fire Pump Service	9665
Self Starters (Schureman Type) for Slip Ring Motors	9670
Self Starters (Schureman Type) for Squirrel Cage Motors	9680
Float Switches for Alternating Current Motors	9690
Float Switches (Schureman Type) for A. C. Motors	9695

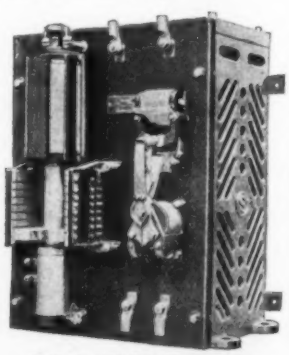
The Cutler-Hammer Mfg. Co., Milwaukee

Largest manufacturers of electric controlling devices in the world

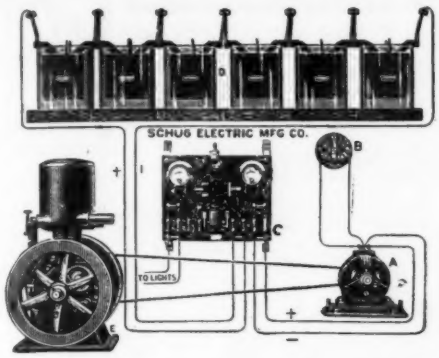
NEW YORK: Hudson Terminal (50 Church Street).
BOSTON: 176 Federal Street.
PHILADELPHIA: 1201 Chestnut Street.
CHICAGO: Peoples Gas Building.
CLEVELAND: Schofield Building.
PITTSBURGH: Farmers' Bank Building.
PACIFIC COAST AGENTS: 579 Howard St., San Francisco, and 229 Sherlock Bldg., Portland. W. B. Palmer, 416 E. Third St., Los Angeles.



Bulletin 9660 Schureman Type A. C. Motor Self-Starter



Bulletin 6150 Schureman Type D. C. Self-Starter



Here's the Profit Maker

All over the country Contractors are realizing handsome profits by handling the complete

"Schug Lighting Outfits"

because the cost is low—because anyone can operate it—because the outfit is the best for all isolated lighting—homes, stores, factories, theatres, boats, motors, etc.

GET IN! Write Now for Prices.

SCHUG ELECTRIC MFG. CO.

Department C, DETROIT, MICH.

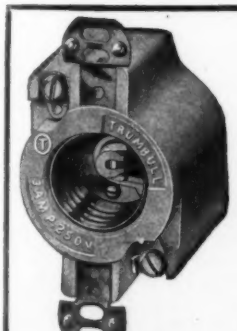
500,000 HOYT METERS IN SUCCESSFUL SERVICE

is the history of our progress for eight years.

70 per cent of the electrically lighted automobiles equipped with meters carry Hoyt. A striking proof of Hoyt quality and Hoyt service.

Hoyt Electrical Instrument Works

Penacook, N. H.



New design of receptacle--Spring contact--and two sets of ears to allow for any variation and fit any box--1 1/8 in. deep.

Flush Receptacles

New Design—Fit any standard box.
Two sets of supporting screws.
Binding contacts at front. Plate is countersunk.

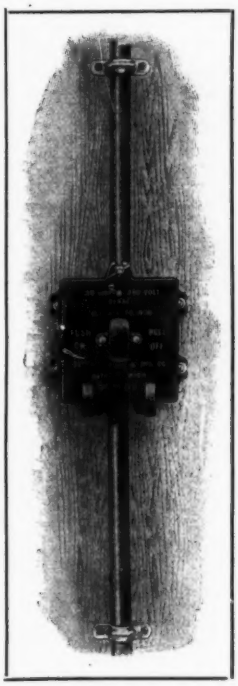
Ask your dealer.

The Trumbull Electric Mfg. Co.

PLAINVILLE, CONN.

Chicago Office: 15 S. Desplaines St.
New York " 114 Liberty Street

Six Reasons Why You Should INSTALL "DETROIT"



Ironclad Fused Switches

1– Enclosed live parts

2– Rugged construction

3– No repairs

4– No shutdowns

5– No danger to employes

6– Lasting satisfaction

Against these advantages weigh the following

Six Reasons Why You Should Abandon the Old Way of

1– Exposed live parts

2– Flimsy construction

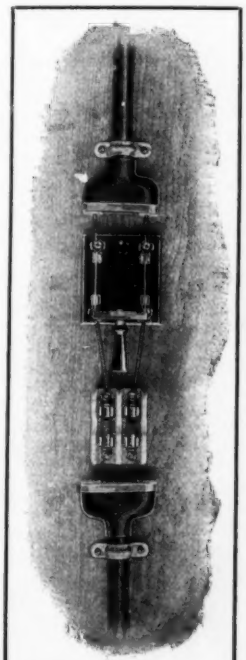
3– Frequent repairs

4– Frequent shutdowns

5– Frequent accidents to employes

6– Constant trouble

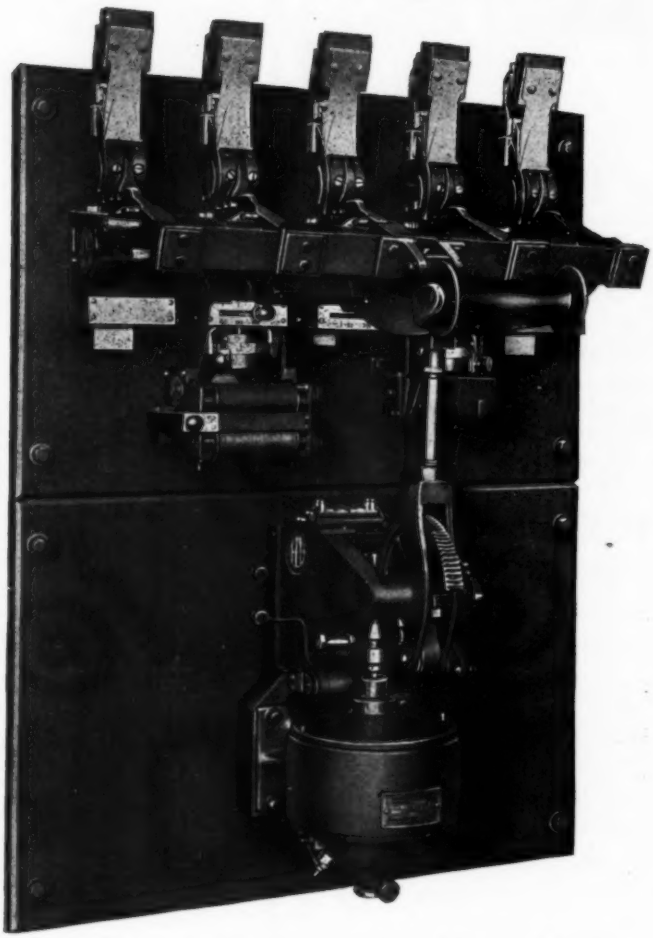
Read ALL the reasons in Catalog 21



DETROIT FUSE & MFG. CO.

1415 Rivard Street, Detroit, Mich.

I-T-E the Standard With Which Others are Compared



The protection of Three-wire Generators operated in parallel presents a variety of conditions which in many cases can most effectively be dealt with by the use of Remote Control Circuit Breakers.

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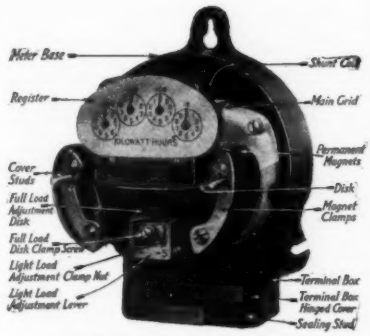

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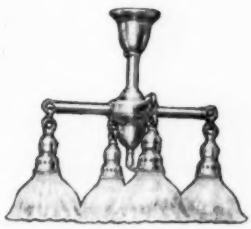

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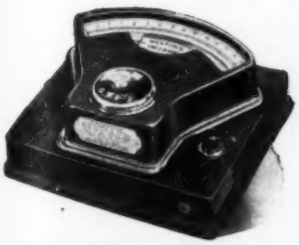

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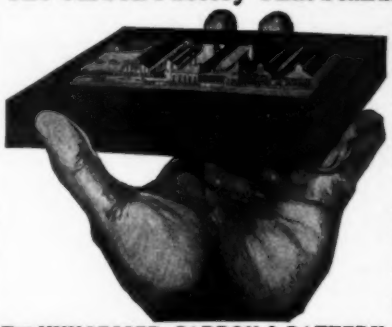

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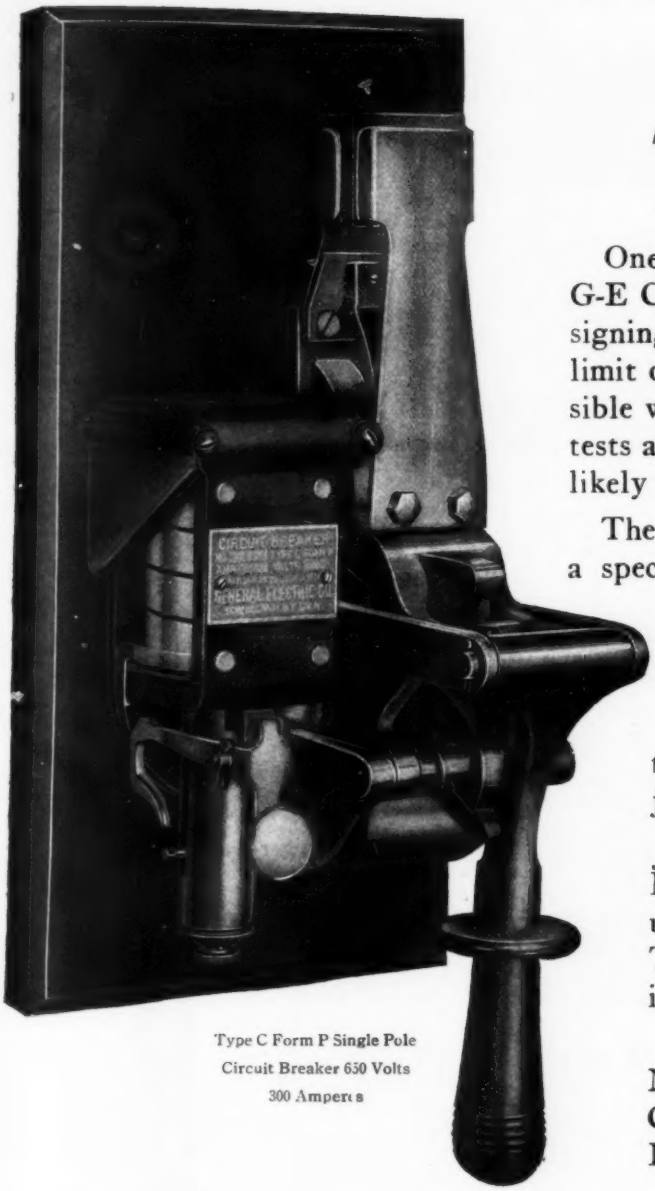

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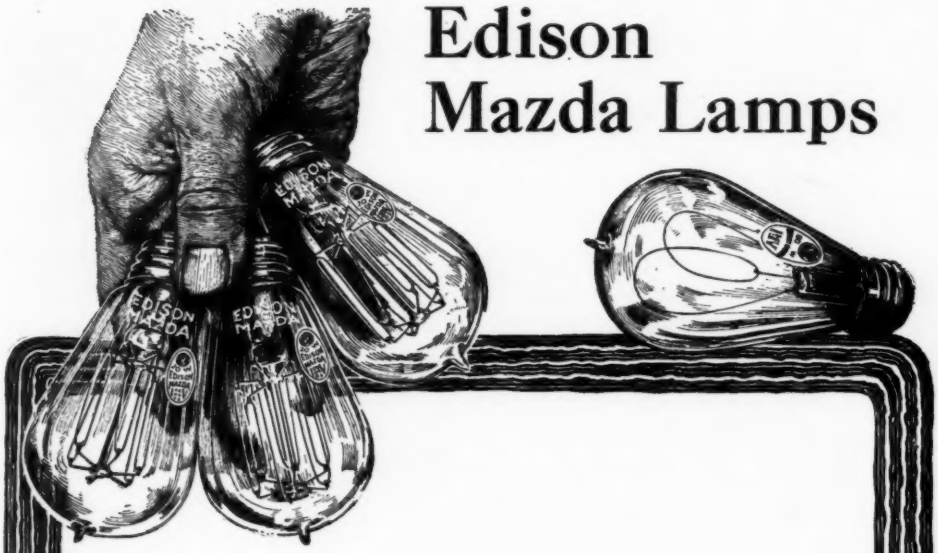

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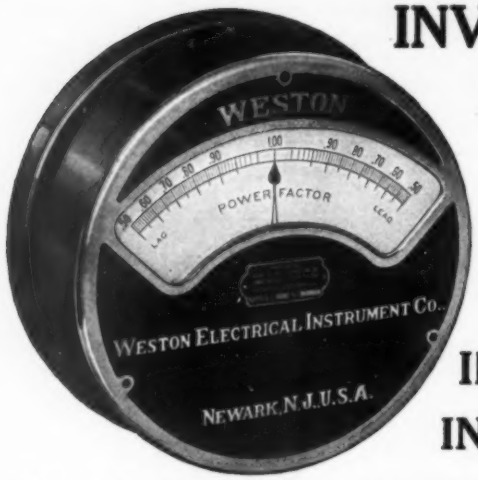

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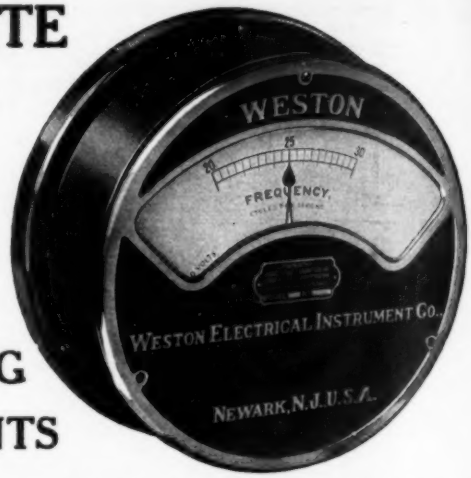

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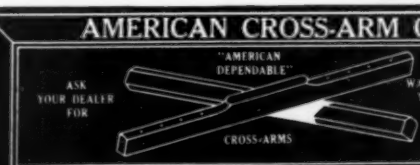

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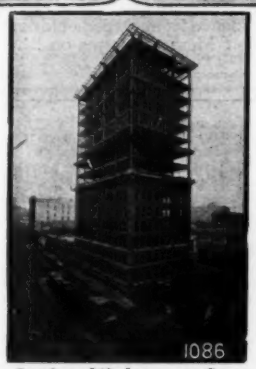

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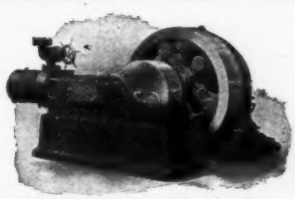

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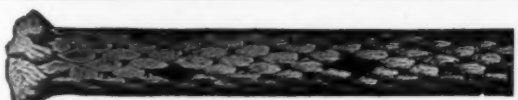

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CHANGERS, Inc. Lamp.
W. N. Matthews & Bro.
McGill Mfg. Co.

CHARGING OUTFITS.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
General Electric Co.

CHOKE COILS.
A. & J. M. Anderson Mfg. Co.
General Electric Co.
Westinghouse Electric & Mfg Co.

CIGAR LIGHTERS.
General Electric Co.
Helion Electric Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CIRCUIT BREAKERS, Automatic.
Cutler-Hammer Mfg. Co.
Cutter Co.
Fort Wayne Electric Works.
General Electric Co.
Independent Electric Mfg. Co.
Sundh Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg Co.

CLAMPS, Boltless Guy.
W. N. Matthews & Bro.

CLAMPS, Cable Supporting.
Electrical Engineers' Equipment Co.
W. N. Matthews & Bro.

CLAMPS, Insulator.
Electrical Engineers' Equipment Co.
Fairmount Electric & Mfg. Co.

CLAMPS, Two Bolt Guy.
W. N. Matthews & Bro.

CLEATS, Fibre.
Blake Signal & Mfg. Co.
General Electric Co.

CLEATS, Insulating.
Hemming Mfg. Co.
Mineralac Electric Co.

CLIMBERS, Linemen's.
Klein & Sons, Mathias.
Oshkosh Mfg. Co.
Western Electric Co.

CLOTH Insulating.
Massachusetts Chemical Co.
Mica Insulator Co.
Packard Electric Co.
Standard Paint Co.
Standard Underground Cable Co.
Westinghouse Electric & Mfg. Co.

CLASSIFIED INDEX—Continued

CLUSTERS.
Benjamin Electric Mfg. Co.
Federal Sign System (Electric).
McGill Mfg. Co.
Nelite Works.
Western Electric Co.

COAL MINING MACHINERY.
Allis-Chalmers Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

COILS.
American Electrical Works.
Belden Mfg. Co.
D & W Fuse Co.
General Electric Co.
Independent Lamp & Wire Co.
Kellogg Switchboard & Supply Co.
Manhattan Electrical Supply Co.
W. R. Ostrander & Co.
P. R. Mfg. Co.
Schug Electric Mfg. Co.
Stanley & Patterson.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

COMMUTATOR LUBRICANTS.
Joseph Dixon Crucible Co.
Goldmark Co., James.
McGill Mfg. Co.
K. McLennan & Co.

COMMUTATOR TRUING DEVICES.
Jordan Bros.

COMPOUNDS, Boiler Cleansing.
Dearborn Chemical Co.
H. W. Johns-Manville Co.

CONDENSERS, Electric.
Leeds & Northrup Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CONDENSERS, Steam.
Allis-Chalmers Co.
Westinghouse Mach. Co.

CONDUIT.
American Conduit Co.
American Conduit Mfg. Co.
Central Tube Co.
Clifton Mfg. Co.
Safety Armorite Conduit Co.
Sprague Electric Works.
Tubular Woven Fabric Co.

CONDUIT RODS.
F. Bissell Co.
Standard Underground Cable Co.
Western Electric Co.

CONDUIT, Underground. Clay, Composition, Wood.
American Conduit Co.
American Cross Arm Co.
H. B. Camp Co.
H. W. Johns-Manville Co.
McRoy Clay Works.

CONDUIT ENGINEERS & CONTRACTORS.
G. M. Gest.
Graner-Mahoney Contracting Co.
J. W. Turner Improvement Co.

CONSTRUCTION, Engineering.
Arnold Co.
Byllesby & Co., H. M.
Central Station Engineering Co.
Electrical Engineers' Equipment Co.
New England Engineering Co.
Stone & Webster Eng. Corp.
White & Co., J. G.
Zimmerman Co., W. H.

CONTROLLERS, Flat Rate.
Eclipse Electrical Mfg. Co.

CONTROLLERS, Printing Press.
Allis-Chalmers Co.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Independent Electric Mfg. Co.
Westinghouse Electric & Mfg. Co.

COOKERS, Fireless Electric.
Copeman Electric Stove Co.

COOKING DEVICES, Electric.
Copeman Electric Stove Co.
Cutler-Hammer Mfg. Co.
Federal Sign System (Electric).
General Electric Co.
Manhattan Electrical Supply Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

COPPERS, Battery.
Manhattan Electrical Supply Co.
Stanley & Patterson.
Western Electric Co.

CORD, Braided.
Samson Cordage Works.

CRANES & HOISTS.
Allis-Chalmers Co.
Jordan Bros.
Sprague Electric Works.

CRANE MOTORS.
Crocker-Wheeler Co.
Ft. Wayne Electric Works.
General Electric Co.
Triumph Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CROSS ARMS. (Wood.)
American Cross Arm Co.
F. Bissell Co.
Lindsley Brothers Co.
Wm. Mueller & Co.

CURLING IRONS, Electric.
Pelouse Mfg. Co.
Simplex Electric Heating Co.

CUT OUTS. Enclosed Fuse, Plug, Combination Rosette, Cut-Out Bases.
Chicago Fuse Mfg. Co.
Commonwealth Edison Co.
D & W Fuse Co.
Detroit Fuse & Mfg. Co.
General Electric Co.
Hart Mfg. Co.
Geo. Heinemann & Co.
H. W. Johns-Manville Co.
Jordan Bros., Inc.
Manhattan Electrical Supply Co.
W. N. Matthews & Bro.
H. T. Paiste Co.
Pass & Seymour, Inc.
Trumbull Elec. Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

CUT-OUTS, Arc Light.
Brady Electric Mfg. Co.
Fort Wayne Electric Works.
General Electric Co.
Philadelphia Elec. & Mfg. Co

CUT-OUTS, Transformer.
D & W Fuse Co.
General Electric Co.
Pass & Seymour, Inc.
Westinghouse Electric & Mfg. Co.

DECORATIVE LIGHTING.
General Electric Co.
Manhattan Electrical Supply Co.
P. R. Mfg. Co.

DIRECT MOTOR DRIVES.
Crocker-Wheeler Co.
Electric Controller & Mfg. Co.
General Electric Co.
Triumph Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

DOOR SWITCHES.
Cutler-Hammer Mfg. Co.
Cutter Co.
Hart Mfg. Co.

DRILLS AND BITS, Electricians.
Daugherty-Smith-Phillips Co.
Morse Twist Drill & Machine Co.

ELECTRODES, Furnace.
National Carbon Co.

ELECTRO-PLATING MACHINERY.
Crocker-Wheeler Co.
Ft. Wayne Electric Works.
General Electric Co.
Roth Bros. & Co.
Sprague Electric Works.
Westinghouse Electric & Mfg. Co.

ENGINEERS & CONTRACTORS.
American Bridge Co.
Ernest J. Andrews.
Arnold Co.
Badt-Westburg Electric Co.
H. M. Byllesby & Co.
Central Station Engineering Co.
Dixon-Smith Engineering Co.
Electrical Engineers' Equipment Co.
Ford, Bacon & Davis.
C. W. Humphrey.
D. C. & W. B. Jackson.
Kohler Bros.
Lamar Lyndon.
McMeen & Miller.
New England Engineering Co.
Chas. A. Pillsbury.
Sargent & Lundy.
Stone & Webster Engineering Corporation.
J. W. Turner Improvement Co.
Western Electric Co.
J. G. White & Co.
Woodmansee, Davidson & Sessions.

ENGINES, Gas and Gasoline.
Allis-Chalmers Co.
Westinghouse Machine Co.

ENGINES, Steam.
Allis-Chalmers Co.
Ridgway Dynamo & Engine Co.
Westinghouse Machine Co.

EXTINGUISHERS, Fire.
Goldmark Co., James.
H. W. Johns-Manville Co.

FANS, Motor and Disc.
Adams-Bagnall Electric Co.
Century Electric Co.
Colonial Fan & Motor Co.
Crocker-Wheeler Co.
Diehl Mfg. Co.
Emerson Electric Mfg. Co.
Fort Wayne Electric Works.
General Electric Co.
Manhattan Electrical Supply Co.
Peerless Electric Co.
Robbins & Myers Co.
Sprague Electric Works.
Wagner Elec. Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

FAULT FINDERS, Electric.
Electric Controller & Mfg. Co.
W. N. Matthews & Bro.

FIREPLACES, Electric.
General Electric Co.
Westinghouse Electric & Mfg. Co.

FITTINGS, Conduit Terminals, Bushings, Entrance Caps.
Appleton Electric Co.
Crouse-Hinds Co.
Fairmount Electric & Mfg. Co.
H. T. Paiste Co.
Sprague Electric Works.
T. W. Manufacturing Co.
V. V. Fittings Co.

FITTINGS, Fixture (Brass).
Fairmount Elec. & Mfg. Co.

FIXTURES, Electric & Gas.
Frank Adam Elec. Co.
Adams-Bagnall Electric Co.
Beardslee Chandelier Mfg. Co.
Benjamin Electric Mfg. Co.
Federal Sign System (Electric).
Western Electric Co.

FIXTURES, Indirect Lighting.
Central Electric Co.
Federal Sign System (Electric).
National X-Ray Reflector Co.

FIXTURES, Show Case.
Benjamin Electric Mfg. Co.
H. W. Johns-Manville Co.
National X-Ray Reflector Co.

FLASHERS, Sign.
F. Bissell Co.
Eclipse Electrical Mfg. Co.
Reynolds Electric Flasher Mfg. Co.

FLAT IRONS, Electric.
Cutler-Hammer Mfg. Co.
Diamond Electric Co.
General Electric Co.
Helion Electric Co.
Manhattan Electrical Supply Co.
Pelouze Mfg. Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

FLUXES, Soldering.
Blake Signal & Mfg. Co.
Burnley Battery & Mfg. Co.
Chicago Fuse Mfg. Co.
H. W. Johns-Manville Co.
McGill Mfg. Co.
Manhattan Electrical Supply Co.
Western Electric Co.

FUSE PLUGS.
Albert & J. M. Anderson Mfg. Co.
D & W Fuse Co.
General Electric Co.
H. W. Johns-Manville Co.
C. S. Knowles.
Stanley & Patterson.
Westinghouse Elec. & Mfg. Co.
Western Electric Co.

FUSE WIRE.
Appleton Electric Co.
General Electric Co.
Western Electric Co.

FUSES.
Chicago Fuse Mfg. Co.
D. & W. Fuse Mfg. Co.
Detroit Fuse & Mfg. Co.
General Electric Co.
Johns-Manville Co., H. W.
Westinghouse Electric & Mfg. Co.

GAINS, Steel.
Belden Mfg. Co.

GEARS, Rawhide and Composition.
Chicago Rawhide Mfg. Co.
General Electric Co.
New Process Raw Hide Co.

GENERATORS.
Allis-Chalmers Co.
Crocker-Wheeler Co.
Eck Dynamo & Motor Co.
Fort Wayne Electric Works.
General Electric Co.
Ridgway Dynamo & Engine Co.
Triumph Electric Co.
Westinghouse Electric Mfg. Co.

GLASSWARE, Illuminating.
Jefferson Glass Co.
National X-Ray Reflector Co.
Nelite Works.
Phoenix Glass Co.
Western Electric Co.
Westinghouse Electric & Mfg Co.

GLOBES, Arc Light. (Outer and Inner.)
General Electric Co.
Phoenix Glass Co.
Western Electric Co.
Westinghouse Electric & Mfg Co.

GRAPHITE.
Joseph Dixon Crucible Co.
Holmes Fibre-Graphite Mfg. Co.

GROUND CLAMPS.
Belden Mfg. Co.
Fairmount Electric & Mfg. Co.
Federal Sign System (Electric)
General Electric Co.
Hart Mfg. Co.
Geo. Heinemann & Co.
Mineralac Electric Co.
H. T. Paiste Co.
Sprague Electric Works.
Thomas & Betts Co.
Western Electric Co.

GROUNDING DEVICES.
Belden Mfg. Co
Fairmount Electric & Mfg. Co.
Federal Sign System (Electric).

GUARDS, Inc. Lamp.
Benjamin Electric Mfg. Co.
McGill Mfg. Co.
W. N. Matthews & Bro.

GUY CLAMPS.
American Steel & Wire Co.
W. N. Matthews & Bro.

HANGERS, Conduit and Moulding.
Mineralac Electric Co.
Western Electric Co.

HANGERS AND CLAMPS.
F. Bissell Co.
Mineralac Electric Co.
W. R. Ostrander & Co.
Pass & Seymour, Inc.
Sprague Electric Co.
Standard Underground Cable Co.
Thomas & Betts Co.

HEATERS, Electric.
Cutler-Hammer Mfg. Co.
General Electric Co.
Helion Electric Co.
Simplex Electric Heating Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

HEATING SYSTEMS. Exhaust Steam.
American District Steam Co.

HOISTING MACHINERY, Electric Mine.
Allis-Chalmers Co.
General Electric Co.

HOSE, Rubber.
Diamond Rubber Co.

HOUSES, Pole or Pilot.
F. Bissell Co.

HYDRAULIC MACHINERY.
Allis-Chalmers Co.

INSTRUMENTS.
Bristol Co.
Electric Controller & Mfg. Co.
Eldredge Electric Mfg. Co.
Fort Wayne Electric Works.
General Electric Co.
Hoyt Electrical Instrument Co.
H. W. Johns-Manville Co.
Leeds & Northrup Co.
Machado & Roller.
Manhattan Electrical Supply Co.
W. N. Matthews & Bro.
Mineralac Electric Co.
Wagner Elec. Mfg. Co.
Westinghouse Electric & Mfg. Co.
Weston Electrical Instrument Co.

INSULATING CEMENTS.
Dickinson Mfg. Co.
Massachusetts Chemical Co.
Westinghouse Electric & Mfg Co.

INSULATING MACHINERY.
New England Butt Co

CLASSIFIED INDEX—Continued

INSULATING PAINTS AND COMPOUNDS.
H. W. Johns-Manville Co.
McGill Mfg. Co.
Massachusetts Chemical Co.
Mica Insulator Co.
Mineralac Electric Co.
Standard Paint Co.
Standard Underground Cable Co.
Westinghouse Electric & Mfg. Co.

INSULATION, Hard Rubber Composition, Etc.
Diamond Rubber Co.
Dickinson Mfg. Co.
Electrose Mfg. Co.
General Bakelite Co.
Hemming Mfg. Co.
Westinghouse Electric & Mfg. Co.

INSULATORS, Arc Lamp.
Albert & J. M. Anderson Mfg. Co.
General Electric Co.
H. W. Johns-Manville Co.
Westinghouse Electric & Mfg. Co.

INSULATORS, Glass.
Brookfield Glass Co.
General Electric Co.
Hemingray Glass Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

INSULATORS, High Voltage.
Electrical Engineers' Equipment Co.
Electrose Mfg. Co.
Fairmont Electric & Mfg. Co.
General Electric Co.
H. W. Johns-Manville Co.
Westinghouse Electric & Mfg. Co.

INSULATORS, Wood.
Mineralac Electric Co.
Westinghouse Electric & Mfg. Co.

IRIDIO-PLATINUM.
Baker & Co.

JARS, Battery (Glass).
Brookfield Glass Co.
Hemingray Glass Co.

JOINTS, Cable.
Dossert & Co.
General Electric Co.
W. N. Matthews & Bro.

JOINTS, Fixture Insulating.
Federal Sign System (Electric).
Thomas & Betts Co.

KITCHEN CABINETS.
Federal Sign System (Electric).

LACQUER, Metal.
General Bakelite Co.

LAMPS, Arc.
Adams-Bagnall Electric Co.
Albert & J. M. Anderson Mfg. Co.
Fort Wayne Electric Works.
General Electric Co.
Koerting & Mathiesen.
Philadelphia Electrical & Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

LAMP CHANGERS, or REPLACERS.
W. N. Matthews & Bro.

LAMP REGULATORS.
Any Lite, Inc. Lamp Regulator Co.

LAMPS, Incandescent Miniature, Carbon Filament, Metal Filament.
Aetna Lamp Co.
General Electric Co.
Monarch Incandescent Lamp Wks.
Packard Lamp Wks.

LAMPS, Incandescent.
Aetna Lamp Co.
American Electric Lamp Wks.
Banner Electric Wks.
Boston Incandescent Lamp Co.
Brilliant Electric Wks.
Bryan-Marsh Electric Wks.
Buckeye Electric Wks.
Colonial Electric Wks.
Columbia Inc. Lamp Wks.
Economy Electric Wks.
Fostoria Incandescent Lamp Works.
Franklin Electric Mfg. Co.
General Electric Co.
General Inc. Lamp Wks.
Independent Lamp & Wire Co.
H. W. Johns-Manville Co.
C. S. Knowles.
Laco-Phillips Co.
Lux Manufacturing Co.
Monarch Inc. Lamp Wks.
Munder Electric Wks.
New York Incandescent Lamp Co.
Packard Lamp Works.
Peerless Lamp Works.
Shelby Lamp Wks.
Standard Electric Wks.
Sterling Electrical Lamp Wks.
Sunbeam Inc. Lamp Wks.
Union Light & Supply Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.
Westinghouse Lamp Co.

LAMPS, Vapor and Vacuum Tube.
Cooper Hewitt Electric Co.
General Electric Co.

LIGHTING PLANTS.
Crocker-Wheeler Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

LIGHTNING ARRESTERS.
Albert & J. M. Anderson Mfg. Co.
Delta-Star Electric Co.

LIGHTS, Desk.
Federal Sign System (Electric).
Johns-Manville Co., H. W.
Stanley & Patterson.
Straight Filament Lamp Co.

LIGHTS, Stage.
F. Bissell Co.
Universal Elec. Stage Lighting Co.

LINE MATERIALS.
Ajax Line Material Works.
A. & J. M. Anderson Mfg. Co.
General Electric Co.
H. W. Johns-Manville Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

LOCKERS, Metal.
Edward Darby & Sons Co.

LOCOMOTIVES, Electric.
General Electric Co.
Westinghouse Electric & Mfg. Co.

LUBRICANTS.
Dearborn Chemical Co.
Joseph Dixon Crucible Co.

LUGS.
Chicago Fuse Mfg. Co.
Crouse-Hinds Co.
Electrical Engineers Equipment Co.
Trumbull Electric Mfg. Co.

MACHINE TOOLS.
Allis-Chalmers Co.

MAGNETIC SWITCH CONTROLLERS.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Independent Electric Mfg. Co.
Sundh Electric Co.

MAGNETOS, MAGNETO-GENERATORS AND BELLS.
Manhattan Electrical Supply Co.
Western Electric Co.

MAGNETOS, Ignition.
General Electric Co.
Manhattan Electrical Supply Co.
Schug Electric Mfg. Co.

MAGNETS, Electro.
Automatic Electric Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Independent Electric Mfg. Co.
Manhattan Electrical Supply Co.
Sundh Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

MAGNETS, Lifting.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
Independent Electric Mfg. Co.
Sundh Electric Co.
Western Electric Co.

MAGNETS, Permanent.
Automatic Electric Co.
Western Electric Co.

MARINE FIXTURES.
Benjamin Electric Mfg. Co.
Crouse-Hinds Co.
General Electric Co.

MAST ARMS.
Ajax Line Material Works.
Brady Electric Mfg. Co.
Fort Wayne Electric Works.
Philadelphia Electrical & Mfg. Co.
Pittsburgh Transformer Co.

MATTING, INSULATING.
Massachusetts Chemical Co.

MEASURING MACHINES (For Wire Measuring).
Minneapolis Electric & Construction Co.
New England Butt Co.

METERS, Recording.
Bristol Co.
General Electric Co.

MICA.
Chicago Mica Co.
Mica Insulator Co.
Eugene Munsell & Co.

MINING MACHINERY (Motor Driven).
Allis-Chalmers Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

MOTORS AND DYNAMOS.
Allis-Chalmers Co.
Century Electric Co.
Colonial Fan & Motor Co.
Crocker-Wheeler Co.
Diehl Mfg. Co.
Eck Dynamo & Motor Co.
Emerson Electric Mfg. Co.
Ft. Wayne Electric Works.
General Electric Co.
Peerless Electric Co.
Richmond Electric Co.
Ridgway Dynamo & Engine Co.
Robbins & Myers Co.
Roth Bros. & Co.
Sprague Electric Works.
Triumph Electric Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

MOULDING.
H. T. Paiste Co.
Stanley & Patterson.
Trumbull Electric Mfg. Co.

NAME PLATES.
Schwerdtle Stamp Co.

OZONIZERS.
Federal Sign System (Electric).
General Electric Co.

PACKING, Steam.
Clifton Mfg. Co.
Diamond Rubber Co.
H. W. Johns-Manville Co.
New York Insulated Wire Co.

PAINTS, Preservative.
Joseph Dixon Crucible Co.
H. W. Johns-Manville Co.
Massachusetts Chemical Co.
The Standard Paint Co.
Western Electric Co.

PATENT SOLICITORS.
Edw. S. Duvall.
Siggers & Siggers.

PHOTOMETERS, Lamp Testing.
Leeds & Northup Co.
Thompson-Lovering Co.

PHOTOMETER STANDARDS.
Electrical Testing Laboratories.

PIGTAILS AND FLEXIBLE LEADS.
Belden Mfg. Co.
Rome Wire Co.

PINS AND BRACKETS, Wood.
American Cross-Arm Co.
F. Bissell Co.
Electrical Engineers Equipment Co.
Wm. Mueller & Co.
Oshkosh Mfg. Co.

PIPE COVERINGS, STEAM.
American District Steam Co.
H. W. Johns-Manville Co.

PLATES, FLUSH SWITCH.
Machen & Mayer Electrical Mfg. Co.

PLATFORMS (Pole Seats).
F. Bissell Co.
Oshkosh Mfg. Co.

PLATINUM.
American Platinum Works.
Baker & Co., Inc.

PLIERS, Wire Cutting.
H. W. Johns-Manville Co.
Mathias Klein & Sons.

PLUGS AND RECEPTACLES, Flush.
General Electric Co.
Hart Mfg. Co.
Machen & Mayer Electrical Mfg. Co.
Manhattan Electrical Supply Co.
H. T. Paiste Co.
Trumbull Electric Mfg. Co.

PLUGS AND RECEPTACLES, Stage.
Frank Adam Electric Co.
General Electric Co.
Manhattan Electrical Supply Co.
Stanley & Patterson.
Universal Electric Stage Lighting Co.
Western Electric Co.

POLES, Concrete.
American Steel & Wire Co.

POLES, Treated.
Lindsley Bros. & Co.
Page & Hill Co.
Valentine-Clark Co.

POLES, Wood.
F. Bissell Co.
Crawford Cedar Co.
Duluth Log Co.
Lindsley Bros. Co.
Mueller & Co., Wm.
National Pole Co.
Naugle Pole & Tie Co.
Page & Hill Co.
Partridge Lumber Co., T. M.
Sandpoint Lumber & Pole Co., Ltd.
Sterling & Son Co., W. C.
Torrey Cedar Co.
Valentine-Clark Co.
Western Electric Co.
C. H. Worcester Co.

POLE CHANGERS.
Kellogg Switchboard & Supply Co.

POLE ERECTORS.
W. N. Matthews & Bro.

POLE STEPS.
American Steel & Wire Co.
Albert & J. M. Anderson Mfg. Co.
Oshkosh Mfg. Co.

PORCELAIN, Special Shapes.
Colonial Sign & Insulator Co.
Findlay Electric Porcelain Co.
Pass & Seymour, Inc.
Star Porcelain Co.

PORCELAIN, Standard.
Colonial Sign & Insulator Co.
Cook Pottery Co.
General Electric Co.
Pass & Seymour, Inc.
Star Porcelain Co.

PORTABLES, Electric Reading Lamps.
Beers Sales Co.
Faries Mfg. Co.
Franks Mfg. Co.
H. W. Johns-Manville Co.

POSTS, Lamp.
Adams-Bagnall Elec. Co.
Cravens Electric Co.
Cutter Co., George.
Flour City Ornamental Iron Works.
King Foundry Co.
McDonnell Boiler & Iron Works.
Wallace Machine & Foundry Co.

POTENTIOMETERS.
Leeds & Northrup Co.

POTHEADS AND SLEEVES.
F. Bissell Co.
Brady Electric Mfg. Co.
Colonial Sign & Insulator Co.
Electrical Engineers' Equipment Co.
Fairmount Elec. & Mfg. Co.
General Electric Co.
Mineralac Electric Co.
Okonite Co.
Standard Underground Cable Co.

PRESERVATIVES, Wood.
Carbolineum Wood Preserving Co.
General Bakelite Co.
Lindsley Brothers Co.

PRINTING ATTACHMENTS FOR METERS.
Mineralac Electric Co.

PRODUCERS, Gas.
Allis-Chalmers Co.
Westinghouse Machine Co.

PROJECTORS, POST CARD.
Victor Animatograph Co.

PROJECTORS, Electric. (Search Lights.)
Fort Wayne Electric Works.
General Electric Co.

PROJECTORS, Telephone.
D & W Fuse Co.

PYROMETERS, Electric.
Bristol Co.
Leeds & Northrup Co.
Thompson-Lovering Co.

PULLEYS, Arc Lamp.
Ajax Line Material Works.
Fort Wayne Elec. Works.

PUMPS, Water.
Allis-Chalmers Co.
Fort Wayne Engineering & Mfg. Co.

PUSH BUTTONS.
Cutler-Hammer Mfg. Co.
Manhattan Electrical Supply Co
Pass & Seymour, Inc.
Western Electric Co.

RACKS AND RINGS, Telephone Distributing.
F. Bissell Co.

RADIATORS, Luminous.
General Electric Co.

RAIL BONDS.
General Electric Co.
H. W. Johns-Manville Co.
Rail Joint Co.
John A. Roeblings Sons Co.
Western Electric Co.

RAIL JOINTS.
Rail Joint Co.
Western Electric Co.

RAILWAY SPECIALTIES, Electric.
A. & J. M. Anderson Mfg. Co.
Blake Signal & Mfg. Co.
General Electric Co

CLASSIFIED INDEX—Continued

H. W. Johns-Manville Co.
Oshkosh Mfg. Co.
Rail Joint Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

RECEPTACLES, Sign.
Benjamin Electric Mfg. Co.
Crouse-Hinds Co.
Federal Sign System (Electric).
General Electric Co.
H. T. Paiste Co.
Pass & Seymour, Inc.
Stanley & Patterson.

RECEPTACLES, Weatherproof.
Crouse-Hinds Co.
Federal Sign System, Electric.
General Electric Co.
H. T. Paiste Co.
Pass & Seymour, Inc.
Stanley & Patterson.

RECTIFIERS.
General Electric Co.
Wagner Elec. Mfg. Co.
Westinghouse Electric & Mfg. Co.

REELS, Wire.
Mathias Klein & Sons.
Minneapolis Elec. & Const. Co.
Oshkosh Mfg. Co.

REFLECTORS, Mirror.
National X-Ray Reflector Co.
Reynolds Electric Flasher Mfg. Co.

REPAIRS, Armature.
Commonwealth Edison Co.
Waterbury Co.
Westinghouse Electric & Mfg. Co.

RESISTANCE, Banks and Units.
Allen-Bradley Co.
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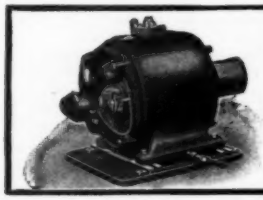

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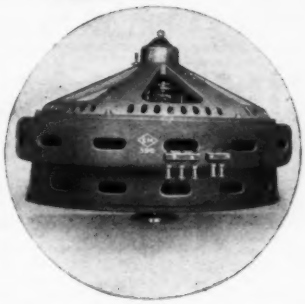

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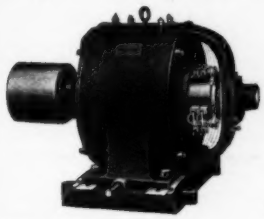

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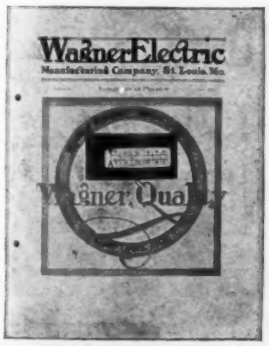

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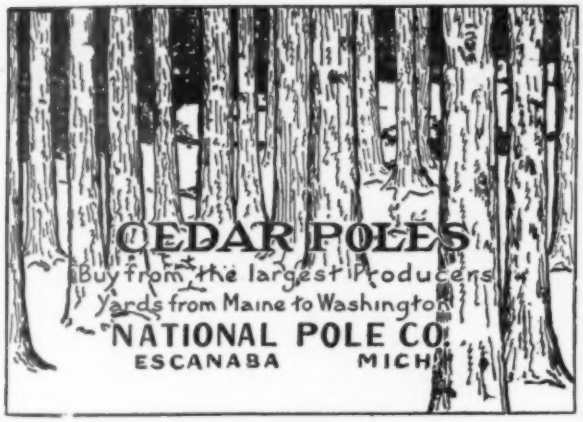

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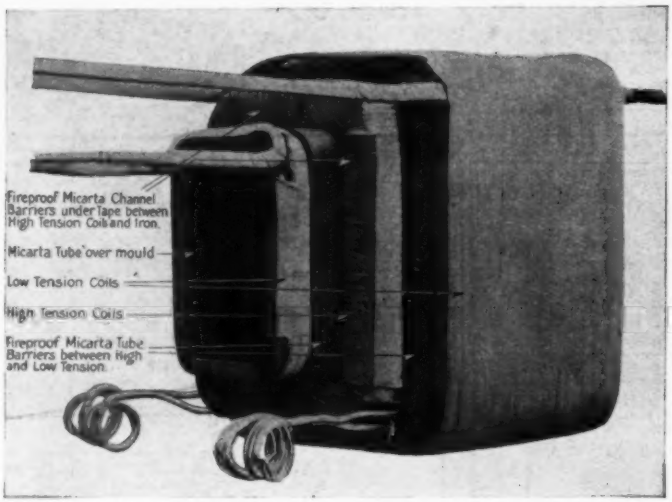
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